THE

# ELECTRICAL REVIEW.

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## ELECTRICAL REVIEW.

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## LOCAL AUTHORITIES AND THE SUPPLY OF ELECTRICAL FITTINGS.

A CASE of signal importance to the electrical world was decided last week by Mr. Justice Eve. We refer, of course, to that of the Attorney-General *v.* the Mayor, &c., of Sheffield. It involved the vital question—Can Corporations or other local authorities who are exercising powers conferred upon them by the Electric Lighting Acts, 1882 and 1888, enter the commercial arena as dealers in electric fittings? Having regard to the bold claim made by the Corporation concerned in the case under review, it is satisfactory, from the point of view of the private wiring contractor, to find that the Court was in a position to grant an injunction.

In the action, which was commenced in 1906, the plaintiff sought to restrain the Corporation, which has power to supply electricity, from carrying on the following, amongst other industries: (*a*) erecting and installing electric light and bell fittings, indoor telephones and lightning conductors; (*b*) keeping a depôt for the display of lamps, fittings, switches, telephones, cigar lighters, &c.; (*c*) effecting repairs to installations, and the repair, &c., of arc lamps; (*d*) the sale, outside their area, of motors, lamps and fittings; (*e*) the supply of electric light fittings, wires and bell fittings and wires in premises not supplied or intended to be supplied by them with electricity; (*f*) repairs for persons to whom they had supplied motors and fittings. Altogether, taking it "by and large," this up-to-date Corporation ran a very tidy little business of a varied character in which capital to the extent of £20,000 to £30,000 was sunk, and from which, as no charge was made against the department in respect of such trifles as interest on capital, rent of premises, or depreciation and obsolete stock, it was able to show a profit rising from £2,645 in 1903 to £2,966 in 1911.

Had it not been for the enterprise of the Sheffield citizen who set the law in motion, this flourishing concern might have continued to prosper, but Mr. Justice Eve has pronounced anathema upon it. As to the branches of industry enumerated in paragraphs (*a*) and (*c*) (*supra*), he pointed out that such enterprise on the part of a municipal electricity authority had already been declared illegal by Mr. Justice Neville in the Leicester case.

The rights of a supply authority, working under a provisional order, are founded on Sec. 10 of the Electric Lighting Act, 1882, which provides that "for the purposes of supplying electricity," the company may acquire such licences, &c., "and generally do all such acts and things as may be necessary and incidental to such supply."

In the case of Attorney-General *v.* Leicester Corporation (1910) 2 ch. 359, it was held that "supply" within the meaning of the section is completed at the consumer's terminals. The installation and provision of lamps, bells, motors and fittings are not part of a "supply" within the meaning of the word as used in Sec. 10 of the Electric

Lighting Act, 1882, but are a separate business, incidental, not to the supply of electricity, but only to its use. For a local authority to carry on such business without express powers, and in reliance on the general words of the section, is accordingly to act *ultra vires*. Mr. Justice Eve, in the case under review, came to the conclusion that all the other items—the private telephones and the lightning rods (which latter, in justice to the Corporation, we should mention were only supplied through a sub-contractor)—were equally illegal. The defendants relied on the Municipal Corporations Act, 1882, and the Sheffield Corporation Act, 1903, in order to establish that their powers were somewhat more ample than those of an ordinary local authority. But this plea failed them.

It is said that the litigation which has culminated as above, after preserving the even tenor of its way for six years, will be taken to the House of Lords. If it should turn out that the two learned judges who have decided this case, and that of the Leicester Corporation, have decided otherwise than in accordance with the law, it is strange that local authorities in various parts of the country should have gone to the trouble and expense of obtaining special powers to indulge in these forms of trading.

## THE CONTRACTOR AND THE MUNICIPALITY.

A paper read before the Society of Municipal Engineers of New York, by Mr. C. A. Crane, secretary of the General Contractors' Association of New York, which appeared in a recent issue of the *Sanitary Record*, is deserving of wide publicity. It is directed specially against the grossly unfair clauses which appear in most municipal conditions of contract all the world over. We commented on an instance from Australia only the other day.

These clauses seem to be known in the States as "Club Clauses." The idea seems to be that they are put in to be used as clubs to knock down the contractor if he fails to give satisfaction to the officials in any particular, whether connected with the clause itself or not.

Mr. Crane quotes the following from a paper by a Mr. Rollins :—

"Every unnecessary or unfair clause in a specification has its part in limiting competition and in lowering the standard of honesty among contractors.

"A clause that may be used as a club may be avoided in one of two ways, either by not bidding on work governed by the clause or by using graft to ensure that it shall be a dead letter."

The usual iniquitous clause making the contractor responsible for the mistakes of the employer or his engineer is once more condemned. It appears that this clause has actually been set aside in the Courts of Connecticut on the ground that the contractor has a right to rely on the information furnished to him by the engineer. The "Engineer Sole Arbitrator Clause" appears also to be rampant in the States.

During the present week the Court of Appeal in this country has decided against the Bristol Corporation in the action which it took against Messrs. John Aird & Co., Ltd., to enforce an arbitration by its own engineer. The Court laid it down that the Engineer could not be judge of his own action; and, inasmuch as actions by him were in question, he has been set aside. We hope that this important decision sounds the knell of this unfair clause.

It is interesting to note that the Institution of Municipal and County Engineers have this week decided to retain it in their conditions, but we fancy they will find that this decision destroys the clause and weakens any set of conditions which contains it.

Suspension or delay of works, so often the cause of loss to contractors everywhere, is touched upon, and it is argued that inasmuch as the contractor is to be fined if he cause delay, so also should the employer compensate the contractor if he orders suspension of works or delays the contractor in any way. On the face of it, this seems to be pure common-sense and justice.

Another gross anomaly is the clause permitting the engineer to vary the design after the contract is signed, and still to hold the contractor responsible for the result.

The effect of a delay caused by the employer (or by another contractor on the same job) in postponing the period of maintenance, and in causing loss of interest on capital, is also discussed.

It might be said by some ardent friend of the principle of municipalising everything: "What does it matter how the contractor is robbed, provided the city gets its work done within the estimate?" This is a very short-sighted view, and grossly immoral as well.

It matters very much every time anyone is robbed, even when it is done with the utmost legality. Not every official —certainly not officials receiving salaries on the scale which prevails in this country—can safely be trusted with a club in his hand. The next thing is that he may be found demanding, "Your money or your life!" and brandishing his club.

What is the result in the long run? Honest, able and trustworthy contractors refuse to tender for municipal work at all.

Even in times like the present, when the building trade is very hungry, some municipal bodies are finding that they cannot get the best contractors in their own town to make them an offer. They have to rely on the riff-raff, or at best on contractors from a distance, who do not yet know their "little ways."

Contractors have a way of telling one another when they have assured themselves that any given official will not let them take their profit, and a bad reputation re-acts on the town and puts up the cost of its works, and eventually its rates.

No subject of the present day calls more urgently for treatment than that of local public works and finance. Chaos is the only word that describes the state of things. Nothing is standardised. Every different city has its own designs (or more likely vague and difficult suggestions) for everything from a road roller to a paving stone. If the Local Government Board has any ideals or standards on any municipal works at all, it is obviously unable or unwilling to enforce their adoption.

Every variety of design or specification means expense. And as if the direct excess of cost were not enough, we find every town sending expensive deputations to every other town to find out and inspect as many more variations from standard practice as possible. Municipal "White elephants" cumber the ground, and we find new loans incurred for new works before the old, which they are intended to replace, have been paid for. Thousands of local authorities employ

thousands of small-salaried engineers to produce tens of thousands of varieties in design and specification of roads, sewers, outfall works, sanitary carts, snow shovels, and what not. Fortunately for the ratepayer, electric lighting stations have been mostly designed to accommodate standard plant of one kind or another. But even in electrical work there is great room for improvement.

In one matter, and one only, with rare exceptions, do they all follow the same practice, and that is in the conditions of contract, and the use of "club clauses."

**Tramcar Meters.**

From Mr. T. B. Goodyer, of Croydon, whose interest in the subject of tramcar meters has on previous occasions been noted in our columns, we have received a summary of replies by twenty-eight municipal tramway managers on the influence of meters on their services, which find employment for over 1,700 cars.

There appears to be a unanimous opinion as to the more even running, better time-keeping, and improvement in the equipment, resulting from the use of the meter. Indeed, only a sceptic would nowadays doubt that considerable economy in working does result from the intelligent use of car meters.

There is, however, another side to this question of the use of meters; economical running by meter may be pushed to an extreme which means dawdling, from the passengers' point of view, and we believe that Mr. Goodyer's own system, among others, is not entirely blameless on this score.

We would emphasise this point strongly; economy in working is purchased dearly when the potential short-distance passenger begins to consider whether he cannot reach his destination almost as quickly on foot.

The existence of tramways depends on their power to attract passengers; and while economising devices are admirable when used with discretion, they must not be allowed to interfere with the convenience of the passenger.

**The Monopoly Question in Germany.**

As mentioned in this journal on former occasions, the Prussian Government in August, 1910, adopted measures for the protection of installation contractors, and the special electrical makers, against the monopolistic efforts of the large firms in connection with installations to be supplied from overland central stations established by the latter firms. The example thus set has, in the meantime, been followed by other Federal Governments, although the degree of success which has attended State action in the matter has apparently not yet been ascertained. Now the Prussian Government has issued a fresh order, explaining and amplifying the principles of the previous order. The new order is not only directed against a direct monopoly as consisting in the exclusive right of carrying out installations to be connected with supply mains, but it also requires that an examination shall be made of the arrangements to see whether they could bring about indirectly a monopoly for individual firms or otherwise make competition unjustifiably difficult. The order then deals with the question as to how far it is admissible to make the right for the execution of connecting works in the supply area of an overland station dependent upon permission being granted to individual contractors. This demand is recognised as justified in so far as it only follows the purpose of affording protection to the central station and consumers against the inefficient execution of works. The only conditions which are to bind the grant of permission for this purpose, and the method of examining the conditions, are fully set forth in the order, which also expressly disallows any limitations in the obtaining of installation materials, lamps, motors, &c.

**Fair Play for Contractors.**

An important question regarding municipal contracts has been raised by a recent decision of the West Ham Municipal Council. The progress of the undertaking makes it necessary that more generating plant should be provided at once. The Council had under consideration an offer for a large set from two of the best-known British contractors, and after all technical details had been arranged, it was finally rejected because the firms in question insisted on inserting what is termed a "lock-out clause" in a contract. The matter is now being re-advertised in the hope that other firms may accept the restriction imposed by the Council.

A "lock-out" clause is practically universally inserted in conjunction with a "strike" clause. These clauses free the contractor from the liabilities incurred by late deliveries, if these deliveries are retarded by cessation of work due to a strike ordered by a Trade Union on the one part, or a lock-out decreed by an Association of Employers on the other. In either event the individual contractor is not the sole controller of the course of events, and if a clause recognising the right of a worker to strike is allowed, then the corresponding right of associated action should be permitted to the employer.

It is through a majority on the Council who are trade unionists that the present difficulty has been raised. They are anxious to strengthen their position, and will not hear of any restriction being placed upon the right of the worker to strike. They state as justification for their attitude that the effect of cessation of work presses harder on the workers, whom it may bring to starvation point, than on the employer, whom it may only ruin, and that on this ground they retain the strike but resist the lock-out clauses.

While an argument of this character might have had some weight in the days of individual action, at the present time when labour disputes take place between collective bodies representing Labour on the one hand, and Capital on the other, it has not the same force. Fair play demands that if the strike is allowed to the worker as the last resource for attack, the lock-out must equally be permitted to the employer as the last resource for defence. We do not anticipate that the present invitation to tender will result in any high-class British firm accepting the position, and, meantime, the undertaking will be placed in great difficulties.

**Electric Cooking.**—"Health, Comfort and Cleanliness in the Home" is the title of an excellent booklet, which, while it is priced 1s., is being circulated free of charge by the Westminster Electric Supply Corporation, Ltd., to all householders taking supply from its circuits, who make application for a copy. It is attractively produced and sets forth in an interesting manner the advantages of cooking by electricity, the matter being accompanied here and there by appropriate sketches, which should appeal to the popular fancy. Mrs. W. T. A. Cross, first-class Diplomée of the National Training School of Cookery, the writer, shows why she prefers electric cooking to any other kind, a few pages being devoted to an elaboration of each of the following claims:—It is easy; it is clean; it is safe; it is hygienic; it is economical; and lastly, it is up-to-date. A list of makers of electric cooking stoves, and advertisements by these firms giving descriptions of their apparatus, appear at the end and they should be of service to the householder after being favourably impressed by the general reading matter in the book.

**Weighty Transactions.**—We recently commented upon an improvement in the arrangement of the printed volumes issued by the American Society of Civil Engineers. The same society now announces that in future in place of the present four annual volumes there are to be two volumes only, each containing as much material as two quarterly tomes, but being only half the bulk of one of them; that is to say, the material bulk of the year's volumes will be only a fourth of what it now is, though the literary contents will be the same. This change is to brought about by the use of India paper. It would be a welcome change could all publications be equally reduced in mass and volume, more especially such as have more than an ephemeral life. Our book-shelves would shrink to a fourth, and we could afford to retain many volumes which we now part with.

# THE USE OF CONDENSERS ON ALTERNATING-CURRENT LIGHTING CIRCUITS.

By A. W. ASHTON, M.Sc.

*Introduction.*—The recent development of a cheap and reliable form of condenser capable of working continuously on 250-volt A.C. circuits has made it possible to run low-voltage incandescent lamps on circuits of higher voltage at a very small first cost, and with an efficiency much greater than is possible with any other type of voltage-reducing apparatus. With this method the lowest voltage lamps can be run on the highest voltage circuits, and it is quite possible and comparatively cheap to run a two-volt lamp on an 11,000-volt circuit.

The idea of using condensers in this way was first developed because of the impossibility of making low-candle-

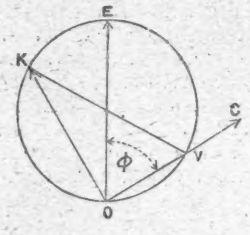


Fig. 1.

power lamps suitable for 250-volt circuits. Recent progress in the manufacture of metal-filament lamps has to some extent limited the application of the condenser for this purpose, although there are plenty of positions in which lamps of less than 14·5 C.P. (the lowest C.P. manufactured for 200-volt circuits) are sufficient.

It has been found, however, that, owing to certain valuable properties possessed by the condenser, it becomes economical even in the case of high-candle-power lamps, to use 25 or 50-volt lamps in series with condensers. Briefly, the reasons for this are :—

1. The condenser prevents damage to the filament due to "overshoot" and the failures which occur due to the initial rush of current when switching on.

2. The low-voltage lamp having a comparatively short thick drawn-wire filament, can be handled without fear of breakage.

3. The blackening due to deposit of the metal on the bulb, caused by electric discharge between the legs of the

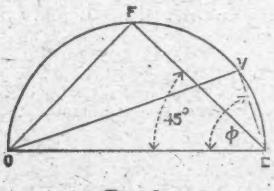


Fig. 2.

filament, is much less with a low-voltage than with a high-voltage lamp.

4. Except in the case of candle-powers of 50 and upwards, the low-voltage lamps are less in first cost and have a higher efficiency.

One outstanding point in connection with the application of condensers is that a variable number of lamps cannot be switched on in parallel, with a single condenser in series with the lot ; therefore, where the ordinary methods of wiring are retained, a separate condenser is used on each lamp or group of lamps controlled by a separate switch. As far as new installations are concerned, the use of a separate condenser for each point has been obviated by the invention of the series condenser system, in which groups of from 10 to 20 lamps are run in series with one condenser.

This system is considerably cheaper in wiring costs than the systems at present used, and it entirely prevents short circuits. It will further be of advantage to the supply engineer, in that the condenser effectively acts as a current limiter, and that the leading currents taken will generally improve the power factor of the whole system.

The above advantages, combined with the use of 10 to 16-watt lamps, costing 1s. 3d. to 1s. 6d. (list), should enable electricity to make great headway in the smaller houses, which at present are almost exclusively lit by gas, and in which the cost of wiring and lamp renewals, rather than the cost of energy, has kept electricity out of the market.

*Theory of the Method.*—The theory of the application of condensers to lighting circuits has several novel features, which may be discussed conveniently with the aid of vector diagrams.

When a condenser is connected in series with a lamp to an alternating-current circuit, the supply voltage O E is split into two components differing 90° in phase. These are O K ($V_1$), the volts across the condenser and O V ($V_2$), the volts on the lamp. The current O C is in phase with $V_2$ and 90° in advance of $V_1$ ; it is determined mainly by the capacity of the condenser and the frequency and voltage of supply, and is in any given case $= 2\pi f K V_1/10^6$, where K is the capacity of the condenser in microfarads. If C = rated current of the lamp, then in order that the lamp should receive its correct current we must make—

$$K = C \times 10^6/2\pi f V_1, \text{ that is—}$$

$$K = \frac{C \times 10^6}{2\pi f \sqrt{E^2 - V_2^2}}, \qquad (1)$$

since E, $V_1$ and $V_2$ form the sides of the right angled triangle K O V. From equation (1) the capacity can be calculated for any given case, provided the curve of E.M.F. is approximately a sine curve.

The current taken by the circuit is the normal current of the lamp at the full voltage of supply, but practically no power is wasted in the condenser, the power factor being—

$$= \cos\phi$$
$$= \cos K V O = O V/K V = V_2/E.$$

Thus the ratio of the lamp voltage to the supply voltage gives the power factor of the circuit, the current, however, being always leading.

By taking an example it can be shown that the current is mainly determined by the condenser ; and that, even if the lamp is short-circuited, the current only increases very slightly. A 50-volt 17-watt lamp requires 5·5 microfarads in series to run properly on a 200-volt 50-period circuit. When the lamp is short-circuited the current becomes—

$$= 2\pi f K E/10^6 = 314 \times 5{\cdot}5 \times 200/10^6 = {\cdot}346 \text{ ampere,}$$

as against ·34 ampere when the lamp is in circuit.

This obviously prevents any considerable rise of current above normal when the lamp is cold, *i.e.*, when switching on.

*The Series System.*—The peculiar current-limiting action of the condenser enables a variable number of lamps to be run in series with the same condenser. The switches are put in parallel with the lamps, and when closed the lamps are short-circuited ; the switches being opened in order to light the lamps.

Provided the sum of the voltages of the lamps alight at once does not exceed 40 per cent. of the supply voltage, they will receive their rated current whatever number is switched on, assuming that the rated current is the same for all the lamps.

The voltages of the lamps may be different, and, in fact, to vary the candle-power the voltages must be proportionally varied. Suppose it is intended to use one-ampere lamps on 220 volts, 50 cycles, then for 10, 16 and 25-watt lamps the voltages must be 10, 16 and 25 volts respectively. Any arrangement of lamps can be used simultaneously provided the aggregate of lamp voltages does not exceed 40 per cent. of 220—*i.e.*, about 90 volts. Therefore five 16-watt lamps could be used at once on this condenser, but seven or eight could be connected, as not all the lamps connected would be required simultaneously. One such condenser would be suitable for running all the lights required for a small five or six-roomed house or flat.

The principle of this method depends on the fact that the current in any given case is determined by the voltage ($V_1$) on the condenser, which $= \sqrt{E^2 - V_2^2}$. When $V_2$ is 40 per cent. of E, it will be found that $V_1$ is about 7 per cent. less than E; this, however, does not mean that the lamps are 7 per cent. below normal current, as, owing to the decrease of lamp resistance with decrease of temperature, the reduction in current would only amount to 4 per cent. By adjusting the capacity of the condenser so that the lamp current is correct for 50 volts on the lamps, the current will be 1½ per cent. above normal with one lamp on and 3 per cent. below normal with five lamps on. These variations are negligible compared with those due to inequalities in the lamps themselves, which, moreover, have less effect on the life of the lamps when a condenser is used.

An important feature of the series system is the way in which, after the 40 per cent. is exceeded, the current gets less and less as more lamps are switched on, so that the maximum power is limited to 0·5 times the apparent power taken by the condenser when across the mains.

This can be best seen from fig. 2, in which O E = supply volts = E, V E = volts on lamps = $V_2$, O V = volts on condenser = $V_1$, $\phi$ = lead of current in advance of supply volts.

Then power taken by circuit = E C cos $\phi$, where C = current = $V_1/R$; R = reactance of condenser; power = $E \cdot V_1/R \cdot \cos\phi = V_1 V_2/R$, since $V_2/E = \cos\phi$. The product $V_1 V_2$ is a maximum when $V_1 = V_2$, *i.e.*, when V is at F and $\phi = 45°$. The maximum power is therefore $= E^2/2R$ = half the apparent power taken by the condenser when no lamps are in circuit.

In the example above, for a condenser taking one ampere on a 220-volt circuit, the maximum power is 110 watts. This property of the condenser makes it unnecessary to fix maximum-demand indicators or current limiters where the contract-demand or maximum-demand systems of charging are adopted.

Where the number of lamps alight at once is not varied, their aggregate of voltages may be about 75 per cent. of the supply voltage, but it is not desirable to have the lamp voltages greater than this figure, as this would considerably increase the cost of the condenser. For instance, three 50-volt lamps or four 40-volt lamps may be run in series on a 220-volt circuit, but not four 50-volt lamps.

*Applications of Condenser Systems.*—The parallel system may be conveniently applied to houses already wired, and can be adopted for a single lamp or any number of lamps as may be convenient, the remaining lamps being left to run at their original voltage. The system can be applied to those points where the greatest saving can be effected, *i.e.*, where low-candle-power lamps are sufficient or where the number of breakages is abnormal. The following example shows the saving that can be obtained with this system. A 100-volt lamp of 22·5 C.P. consumes 25 watts, whilst a 200-volt lamp of the same candle-power consumes 32 watts. Assuming a life of 2,000 hours, in each case the saving in energy alone is 14 units, *i.e.*, 7s. at 6d. per unit, which is about the cost of the condenser for 220 volts, 50 periods. Where, however, the frequency is higher, the cost of the condenser is correspondingly reduced.

The condenser may be fixed under the floor above the ceiling rose, or on the wall near the switch. In the smaller sizes, a cylindrical type is made with an adapter for inserting in the existing lampholder. For single lamps the condensers have dimensions about 2 in. × 2 in. × 6 in., are made with all live parts efficiently covered, and are all capable of withstanding continuously 250 volts alternating without fear of breakdown.

For lighting private houses the cost per point of the series system with switch lampholders is not more than half that of the ordinary "loop-in" system of wiring. This saving is effected owing largely to (*a*) simplicity in wiring, there being only one wire run from lamp to lamp; (*b*) the distribution board being replaced by one pair of double-pole fuses; (*c*) the difference in cost between low-voltage and high-voltage lamps, viz., about 1s. 6d. per lamp. With regard to (*a*) it can be shown that the length of wire is reduced from about 20 yards per point to 8 yards per point, with a corresponding saving in labour and conduit.

For street lighting, high-candle-power incandescent lamps can be used to replace arc lamps in series without altering the wiring, the condensers simply replacing the arc lamp resistances. The same method can be adopted for outside shop-lighting, where the trouble of recarboning arc lamps is operating to the advantage of high-pressure gas. In both cases the prevention of damage from overshoot and the more robust filament of the low-voltage lamp amply compensate for the small initial outlay on the condenser.

## THE FETISH OF "BOILER INSURANCE."

By S. LEES.

It is pretty safe to say that at the present day there is hardly a steam-power plant of any importance that is not "insured" in the usual way. And he would be a bold spirit indeed who would dare to suggest that the insurance of steam-raising plant was an unnecessary superfluity. There is an almost sacred atmosphere about the engineering insurance business, and the preacher of no-insurance would instantly stand charged with the wickedest form of engineering heresy breatheable,

Looking at the question of boiler insurance broadly from an economic standpoint, what advantages or benefits does the insured owner get in return for the premiums paid? Periodical inspections are made, and reports thereon are furnished for the edification of the owner, but such information is at least as much in the insurance company's interest as in that of the insured party. And such inspections cannot really be said to be of any especial value to an owner, as in any steam-power plant worthy of the name the very engineering staff forms the class of men from which the average engineer inspector or surveyor is drawn.

Reference to annual engineering-insurance reports for the past year or so, reveals a falling off in this class of business. And in its 1911 report recently issued by one of the leading companies, mention is made of the diminishing rate of increase in the insurance of steam-raising plant and auxiliaries; the reason therefor being partly ascribed to the supersession of steam by gas, electric, and other non-steam plant. Such a statement emanating from a reliable authority is not without significance. Is it not more than possible that owners of steam plant are beginning to look more deeply into details, which hitherto more favourable industrial conditions had not rendered of such pressing consequence as regards their bearing on the more important matters, especially production costs? At this day it can be truly said that it is the little things which count.

Power plant manufacturers, and owners and operating engineers, are ever striving after increased efficiency and economy, and to these ends are constantly introducing and trying innovations in the way of improvements and finenesses of working for which a keenly competitive age has created a demand. Of the many new things and methods which are being daily evolved, but few survive the only true criterion—the time test, some are indifferent, and the majority distinctly bad, and as such doomed to inevitable failure under the rigorous conditions of present everyday working life.

There are hundreds of steam plants of considerable size and importance, say, in the neighbourhood of 30 boilers, and the bulk of these will have been insured from the day of installation, and a goodly proportion of this number will probably be from 15 to 20, and in some cases more, years of age.

Now, with many owners it is as likely as not that during the whole of this time nothing untoward in the way of accident will have happened to their boilers. But supposing that some defect or other having developed—other than actual explosion, using the word explosion in its generally accepted meaning—it becomes necessary to repair a plate or tube or stay, eventualities by no means unheard of. The matter is, of course, duly discussed with the insurance company, and the owner not unnaturally feels that the responsibility of "making good" will be borne by the insurers. His optimistic view, however, is soon dispelled when the company

convey to him the unexpected news that they repudiate financial responsibility for such contingencies, their legal liability, as clearly shown on the insurance policy, being limited to explosion. The owner indignantly criticises the (to him) unreasonable attitude adopted by the company, but it is pointed out that during the whole of the time the premiums have been paid the owner has had the benefits of thorough inspection and the valuable resources of the company in the way of advice, &c., placed at his disposal. The unhappy owner, reflecting over the matter, argues to himself that his engineering staff is, or, at any rate, should be, equally as competent to deal with any engineering problem which may arise on his plant as the insurance company's staff, and from a commercial standpoint he may come to the conclusion that in future he will take the "risk" of explosion upon his own shoulders, and have his own engineering department make all necessary inspections, examinations, &c. Perhaps as an inducement to increasing the efficiency of his engineering staff, the owner may hold out as encouragement in this direction the prospect of increase of pay. He may also have an idea that a fund to draw on for such a purpose might well be started with, as a nucleus, the amount of the premiums hitherto set aside for payment to the insurance company.

That engineering insurance occupies such an unquestionably important position in the commercial world is hardly to be wondered at, considering that the legal liability on the insurer's part is so limited and narrowly defined, and the apparently low premium charges would seem to indicate that engineering insurance generally, and, in particular, the boiler class, is a "good risk," to use an insurance phrase.

The whole subject of insurance is wrapped up in legal technique, and the engineering side is no exception; but it seems curiously inconsistent that such a striking difference of practice should obtain in two otherwise closely related departments, as the boiler and engine branches. As already mentioned, with the former the risk is limited to "explosion" (what potential material for the forensic mind of the legal fraternity the legal definition, according to the particular circumstances, this otherwise simple word affords). But in the case of engines and auxiliaries, and one might well include electrical plant, the risks accepted are broader, and, in fact, extend to practically all possible contingencies which may arise. Not that insurance companies always liquidate claims smilingly; such arrangements as compromises with the owners or makers of insured plant are not unheard of. Even so, does it not seem strange that such an inconsistent practice should obtain in different branches, considering how closely allied these are in their respective working? Furthermore, the imagination need not be drawn upon unduly for one to realise how an unexpected happening on either the engine or the boiler side may render one or the other susceptible to its influence, and be the cause indirectly, possibly, of further undesirable developments.

The writer does not wish to belittle the undoubted good and useful work carried on through the medium of engineering insurance, but is this form of insurance such a necessity, at any rate, in the case of the larger plants, as its advocates would have owners and users believe? For, be it said, the more important the plant, and the more certainly will it be insured. But, strangely, the very class of plant which it would seem at least desirable to subject to strict and more frequent periodical inspection is the one in which anything approaching to general insurance does not by any means obtain. Statistics have shown only too often how the penny-wise policy of unskilled or inadequate attention has come to grief, and a timely report has been the means of bringing the fact plainly to the mind of many an owner how near his own plant has been to disaster what time he has reluctantly, it is true, become a convert to the policy of insurance. With this class of plant, and there are many of such examples working without anything approaching to skilled supervision—indeed, it has been shown that steam boilers working at considerably above atmospheric pressure have been in regular charge of juvenile and female labour—insurance, in some form or other, is almost imperative, as the statutory obligations imposed on owners of steam plant, if not appreciated or interpreted in their proper light, may be of no value whatever as affecting the condition of the plant, and, after all, this is the point which is of primary importance and really antecedent to the legally necessary and formal annual inspection.

The time-honoured code of stereotyped rules and instructions usually framed by the engineering insurance people for users has always appealed to the writer, more on account of its curious inconsistencies than as a guide and help. In scarlet italics the legend, "Telegraph for the Inspector," boldly appeals, so that he who runs may read. But offices are offices the whole business world over, and Insurance establishments run a close second to the banking houses in the matter of business hours, so that a wire after conventional office times would, in all probability, mean redelivery, and mishaps, cussed-like, would seem in the very nature of things invariably to happen at most awkward and unexpected times.

## ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(*Continued from page* 291.)

6. *British Columbia.*—It is provided by an "Act to consolidate and amend the law relating to the incorporation of municipalities" (1897), Sec. 50, that in every municipality the Council may, from time to time, make, alter and repeal by-laws for any of the following purposes or in relation to matters coming within the classes of subjects next hereinafter mentioned, that is to say, "(*inter alia*) (11) for purchasing, constructing, operating and maintaining works for supplying the inhabitants of the municipality with water, electricity or gas, and regulating the conditions and terms under which the same may be supplied and used. (12) For acquiring, by purchase or otherwise, any tramway, street railway, ferry, gas works or electric lighting plant already constructed or established wholly or partly within the limits of the municipality, and to lease or maintain, operate and extend, as may seem expedient, the same in the discretion of the Council by resolution passed from time to time in that behalf."

The statute above referred to appeared to meet all the requirements of the Legislature until 1910, when the "Electrical Energy Inspection Act," of that year was passed. It recited that "many fatal accidents had recently occurred through defects in the construction or operation of premises, works, wires, and appliances for generating, transmitting and supplying electrical energy." It provided for the appointment by the Lieutenant-Governor in Council of an inspector who has authority at all reasonable times to enter upon premises and inspect machinery, &c. The inspector has power, by virtue of Sec. 9 of the Act, to give notice to the owner of any place to remedy any defect within a specified time, and penalties are imposed for disobedience to any such order. The method of providing for the salary of the inspector, and the expenses of working the Act is somewhat novel: "At the end of each calendar year the Attorney-General shall ascertain the total sum expended during the year in the enforcement of this Act, including the salary of the inspector. The sum so found to have been expended shall be apportioned by the said minister amongst the persons whose premises, works, wires or appliances have been inspected under the provisions of this Act during the year."

7. *British Guiana.*—In 1890 an Ordinance was passed in British Guiana to facilitate and regulate the supply of electricity for lighting and other purposes. It is provided by Sec. 4 that the Governor and Court of Policy may, from time to time, license any local authority, or any company, or person, to supply electricity for any public or private purposes within any area, subject to the following provisions—Here follow a number of provisions which are practically identical with those of the Electric Lighting Act, 1882. Sec. 4 (1) provides that:—"The consent of every local authority having jurisdiction within the area or any part of the area within which a supply is licensed to be furnished shall be required to the application for a licence, which con-

sent such local authority is hereby authorised to give, with such conditions, if any, as subject to the approval of the Governor and Court of Policy the local authority may, if they are of opinion that having regard to all the circumstances of the case such consent ought to be dispensed with, make in a special order dispensing with such consent; but the grant of authority to any undertakers to supply electricity within any area shall not in any way hinder or restrict the granting of a licence to the local authority, or to any other company or person within the same area." As will have been noticed, this provision as to withholding consent follows very closely upon the lines suggested by Sec. 1 of the Electric Lighting Act, 1888. Sec. 27 of the ordinance makes provision for compulsory purchase of undertakings by local authorities on terms which are almost identical with those laid down in Sec. 2 of the Electric Lighting Act, 1888. It is important to notice that the statutory period within which the right of purchase may be exercised is 42 years.

In a case which was heard in the colony in 1902 the appellant alleged that he contracted with the respondents for the supply of electrical energy, that they duly supplied him with such up to a certain date; that he duly paid them, and that they wrongfully cut off the supply. It was held that the section which makes the undertakers liable to a penalty for making default in the supply of energy was not *ultra vires*, and that the fact of the imposition of such penalty did not prevent the appellant suing for breach of his agreement (Gomes *v.* Demerara Electric Co., J. June 21st, 1902).

Two Acts incorporating electrical companies are in force in the colony—namely, the British Guiana Electric Lighting Co. Act (No. 15 of 1903), and Demerara Electric Co.'s Act (No. 13 of 1899).

8. *Canada.*—The law of Canada as applied to electric lighting appears to be founded on the assumption that there are contractors supplying electricity. It merely seeks to regulate these persons. Thus by the Electric Light Inspection Act, 1906, c. 88, contractors before granting a supply must declare to the purchaser the constant pressure at which they propose to supply energy. This pressure must not vary by more than 3 per cent. The contractors are to be responsible for all electric lines, fittings, apparatus belonging to them, or under their control, upon the purchaser's premises, being maintained in a proper condition, but are not to be responsible for any damage arising from the use of the electric current in lines, fittings and apparatus not belonging to them or under their control. Before supplying electricity to any purchaser the contractors must obtain from a Government Department or from an office appointed for the purpose a certificate of registration, and must pay the officer issuing such certificate the fees prescribed by the Governor in Council. Elaborate provision is made for inspection of meters, which must be duly certified. No meter can be fixed for use unless it plainly indicates by means of suitable dials the amount of current or energy passing to the purchaser's wires. If a dispute arises between the contractor and the purchaser (*i.e.*, consumer), or between the contractor and inspector, respecting the correctness of a meter, the inspector must, if so required, by any person dissatisfied, refer that dispute to the Department for final decision.

9. *New Brunswick.*—There does not appear to be any Act of the legislative Assembly of New Brunswick relating to the general supply of electricity. Nevertheless, Acts seem to be passed from time to time, under which the power to supply electricity is conferred upon companies. Thus, in 1902, an Act was passed to incorporate the Aberdeen Electric Co. By that Act the company were empowered to generate and sell electricity, and in carrying out the supply to erect and place poles in streets, &c., such works to be carried out under the supervision of the municipal councils of the various cities in which the works were laid. Sec. 12 of the Act contained a provision to the effect that "No poles or wires shall be placed in such a way as to interfere with the poles or wires of any telephone or electric light company now existing, or as to injure or impair the efficient working of any telephone or electric light system in operation in this province, in places where any such system may be in operation before the company hereby incorporated establishes its system; it being understood, however, that nothing herein shall be construed to prevent the company hereby incorporated from erecting its poles and stringing wires, or laying the same underground, on the opposite side of any highway or street to that occupied by the poles or wires of any existing telephone or electric light system."

*(To be continued.)*

## CORRESPONDENCE.

*Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Opal Shades.

I am interested in the article on page 275 of your February 16th issue on "Opal Shades."

I should like to point out that the writer of the article apparently misses the point in respect of the virtues of scientifically-designed shades, in his endeavour to state the claims for ordinary opal shades.

It is very well known that a certain concentration of light can be obtained from opal shades, just as it can be obtained from any reflecting surface—a piece of tin, glass mirror, or any white surface.

The point is, however, not that these surfaces can reflect, but that there is no definite control of the reflection by which the light can be distributed in a definite, desired form. This is the real advantage for efficient lighting given by scientifically-designed reflectors, such as the Holophane.

The opal shades give a "diffuse" or irregular reflection, and the form of light distribution cannot be definitely controlled; whereas, with Holophane reflectors, by the use of right-angle glass prisms, we secure definite and regular reflection, which admits, shaping the reflector so as to give any desired form of light distribution. This difference marks a distinct advantage for the prismatic glass reflector, as, when properly designed, such reflectors ensure that the light is distributed in accordance with the required conditions for uniform lighting in any installation.

With the definite and efficient reflecting results, therefore, that Holophane reflectors give, it is possible to employ lamps in a much more certain and effective manner for illuminating work than with opal shades.

It is no longer necessary to hang lamps directly in the line of vision, as is so prevalently the case with opal shades, but lamps can be placed well above the line of vision or close to the ceiling, with marked improvement in illuminating results.

Along the line of reasoning given for opal shades, one might argue that it is not necessary to employ a nozzle for a hose, as by pinching the hose at the end one could get the necessary stream or spray of water without purchasing expensive nozzles.

It is important for contractors, engineers and users to have a proper understanding of the value of a scientific and efficient reflector. Illuminating work admits of definite engineering, requiring the use of scientific designs of reflectors, just as, in other kinds of engineering, scientific designs of apparatus are required and are displacing those of a more or less approximate and non-scientific design.

No doubt at the time clocks were invented many people contended that sundials and previous other crude methods of keeping time were sufficiently satisfactory, and it was not necessary to purchase expensive clocks and watches. At the present time clocks and watches have become accepted instruments, giving definite and accurate results, and, in the same way, the prismatic glass and other scientific designs of reflectors should supersede the previous crude designs, such as the opal shade.

It is a fortunate thing for the electric lighting industry that they have available such an excellent, convenient and effective device as the Holophane reflector for securing good illumination. These reflectors are made in three convenient forms to cover the general conditions of lighting. They are made to suit each size of metal-filament lamps. A correctly designed supporting gallery holds them in the

exact focusing position over the lamp, and a complete "lighting unit" or "set" is therefore available in ready form which ensures a definite lighting result, far superior to anything obtained with other types of reflectors, such as the ordinary opal shades. Furthermore, these Holophane reflectors are of proper size and length to enclose the lamp, thus eliminating glare—a material improvement over the results in practice with opal shades, where, in many cases, the lamps protrude their bare brilliancy in a most glaring and unpleasant way.

Nor must Holophane reflectors be considered expensive. While their first cost is naturally somewhat higher than that of the simple pieces of opal glass and such types of reflectors, this first cost is more than returned in the better lighting results these Holophane reflectors ensure.

Good illumination is so much dependent upon effective and efficient reflection, that it is false economy to economise by buying cheap reflectors.

**F. W. Willcox.**

London, E.C., *February 24th*, 1912.

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### Our Progressing Manufacturing Firms.

At the annual dinner of the General Electric Co., and in the *Magnet Magazine*, Mr. Hirst has quite unintentionally furnished a reply to "N. D. G.'s" letter in your last issue. I do not for one moment suggest that "N. D. G." refers to the General Electric Co., though I am sure that 9 out of 12 central-station engineers could speak of similar experiences with several supply firms; nor are "N. D. G.'s" troubles entirely over yet. By March 31st he will receive a statement on which each consignment, sent him in error, will be charged.

Mr. Hirst states that "it was found necessary to form subsidiary companies in order to keep the Witton factories fully employed." Cases have been brought to my notice by colleagues in which two of the largest supply houses, which are specially equipped for the work, were asked to tender for an 8-H.P. three-phase motor and a small switchboard, capable of dealing with a private plant of about 10 KW. In each instance the time required for delivery was about three months; smaller firms offered to supply in 7 to 14 days, and secured the order. Again, a new tungsten lamp was shown at Olympia Exhibition, and the various agents were energetically canvassing for orders shortly afterwards. One engineer ordered 500; I am not quite sure whether he has received the whole of the 500 at present—if he has, he is more lucky than the contractors.

I have the opportunity of watching the methods of our friends, the gas and general engineering supply houses, and I must admit that they have solved the difficulty, as I experience practically no trouble in that direction.

Your readers will ask what is the cause of this difficulty.

In my opinion, it is branch offices and their organisation. Whilst several firms are notable exceptions, the following is a typical case: A's traveller calls to inquire whether I am requiring anything. On a recent occasion I was ordering a three-phase meter, with demand indicator, and also a motor and circuit-breaker. Upon my asking a few questions regarding the speed, power factor, &c., the representative admitted that he knew nothing about it, but would arrange for a meter expert to call. A visit to the local office only produced the same result. A few days later B's traveller called, and upon my asking for the same particulars, he produced his pocket-book of "Technical Data," promptly replied to all my queries, and secured the order. The order was executed in the time stated, and the apparatus proved satisfactory in every way. This firm is an exception, being apparently perfectly organised in works, head office and branches.

If supply houses find it necessary to have so many branch offices, each of these offices should be in charge of a manager who thoroughly understands the whole of the goods he is selling. He should also possess the necessary organising ability, and either train or obtain representatives with a general knowledge of every inquiry they are likely to handle. The head office or works should supply the staff with full general and technical particulars of everything they manufacture (which is the exception rather than the rule). Particular attention should be given to deliveries, and no standard article should be offered for sale until they are in a position to deliver.

Mr. Hirst need only look up the value of electrical goods imported from the Continent to realise that more than enough orders to keep his factories going can be obtained.

**Central Station.**

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### The Electrical Profession As It Is.

With reference to my recent letter on this question, I regret that pressure of other matters has prevented me from replying sooner to the comments and letters which my letter produced. First, I must correct an impression which appears to exist as to my aims and myself. In your editorial comment on my letter you refer to me as someone who is having difficulty in finding a situation; let me make it clear that such is not the case. In the past I *have* held positions of responsibility, neither am I at present seeking a situation, so that your comment is entirely wrong in that respect; my sole object in writing was to put matters as I have seen them, and it is only too true that numbers of men could say exactly the same, were it not that most of them are disgusted and tired of discussing the subject.

Considering matters about hopeless, these men do not rush into the Press with their grievances, and in this, perhaps, they are right, as it appears more evident every day that most of the journals have no sympathy for the unfortunates of the profession, those who have gone under in the struggle for just recognition. I quite realise that the profession contains many would-be engineers, such as plumbers, ironmongers, bellhangers, &c., and of these gentry and the havoc they cause I could say a lot; but in dealing with such a phase of the question we must not forget those who, by training and experience, can legitimately call themselves electrical engineers, but are not getting an honest chance, owing to evils which surround them.

The "premium pupil" and the "improver" evil alone are responsible to a large extent for the present condition of things. It is in the spirit of improvement for all deserving that I write these lines, and in the same spirit I trust they will be read.

**Diogenes.**

[That we deeply sympathise with those who have "gone under" through no fault of their own must be evident to all readers who are familiar with the views we have expressed in our pages. There are also undoubtedly cases of men who have not had a fair chance to prove their worth. But both these classes, as a rule, are silent as to their misfortunes; the noisiest and most self-assertive person is of the kind that knocks off work at the first stroke of the hour; that talks of a "fair day's work for a fair day's pay" and appoints himself the judge as to both items; and that takes no interest in work, though he may be enthusiastic on modes of recreation. We do not wish to class the worker with the shirker, by any means, but the complaint of unrequited merit is usually *prima-facie* evidence, at any rate, that the latter is the complainant. We do not wish by these remarks to cast any reflection on "Diogenes," of whose sincerity we have no doubt.—EDS. E.R.]

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**Motor-Cabs in Berlin.**—The most recent statistics regarding the Berlin cab business show the striking influence which the introduction of auto-traction has exercised, and give also some idea of the position of electric cabs. The total number of "droschkes" in the Berlin Police Circuit reached its highest in the year 1907, when it amounted to over 9,000. Since then the numbers have steadily fallen, until at the beginning of 1911 the figures were 7,900, reduced a further 600 by the middle of July the same year. Motor-droschkes up to 1904 continued few in number, but since then they have steadily increased, and of the 7,000 droschkes there are already nearly 2,000 (= 28½ per cent.) motor-droschkes. Of these 2,000, electric motor-cabs form only 14 per cent. A further increase of motor-droschkes and a rapid retrogression of the horse-drawn vehicle is to be expected. The statistics show only a small increase in electric motor-cabs. On July 1st last, a decline of 21 was recorded, as in consequence of the liquidation of the Bedag Co., 36 electric cabs were disposed of. The notice of the President of Police in favour of motor-cabs gives ground for the supposition that a recovery from this decline would be made by the end of year (1911). It is prescribed that electric cabs shall in future be painted ivory white to distinguish them from petrol motor-cabs, for which a brown livery is ordered.—*E.T.Z.*

# NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

## Hydraulic Sluicing Plant.

We illustrate below an interesting plant which has recently been supplied by Messrs. Jens Orten-Boving & Co., of Union Court, Old Broad Street, E.C., for sluicing purposes to a Colonial mine.

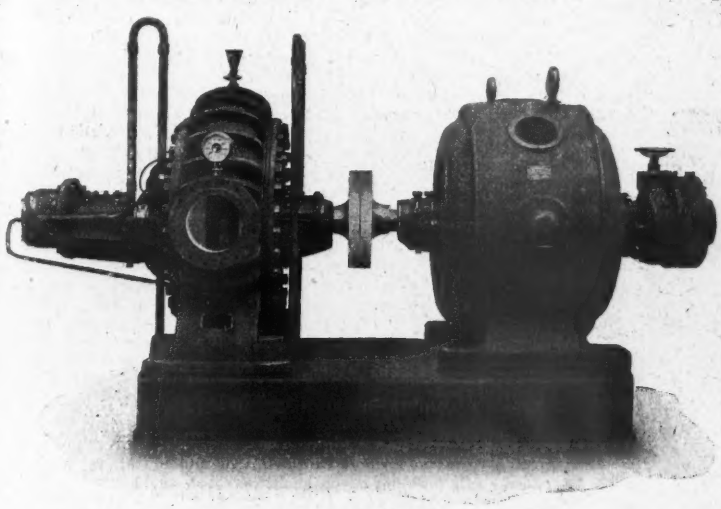

Fig. 1.—Electrically-driven Sluicing Pump.

It consists of a high-pressure multi-stage type Victoria pump, fitted with an impeller and guide wheel of special phosphor bronze, the inner surfaces being carefully finished to reduce friction, &c.

Dismantling and reassembly of the wheels and diaphragms, which fit cylindrically in the casing, are extremely simple matters, and it is impossible for these parts to get out of alignment when the pump is re-erected. The pump is direct driven, through a flexible coupling, by a 710-B.H.P. three-phase motor operating on 2,200-volt 60-cycle current, and connected to a nozzle fitted on a swivel stand, through a steel pipe 2,000 ft. long.

The pump is designed for a total manometric head of 415 ft.; this results in a pressure of between 130 and 150 lb. per sq. in. at the nozzle, according to the position of the latter, and the jet at this pressure is used for forcing off the gravel, stones and boulders from the solid rock of the hill-side where the mining operations are in progress. Careful trials under full load have shown a pump efficiency as high as 83 per cent.

## High-Lift Centrifugal Pumps.

The accompanying illustration shows a double-ended mine pump driven by an electric motor, and designed for delivering 670 gallons a minute against a head of 1,500 ft. when running at a speed of 1,485 R.P.M. This is one of a series of centrifugal pumps for working under high lifts which are being introduced by the Electrical Engineering and Equipment Co., Ltd., of 109-11, New Oxford Street, W.C. In these pumps the runners and guide channels are of special bronze, the suction gland is water-sealed, and the bearings are lined with white metal and provided with ring lubrication. Balancing is effected by the maker's patent hydraulic device, which automatically adjusts itself for variation of head, output and wear; this arrangement is fitted at the pressure end of the pump, and only one bush needs renewal when wear takes place.

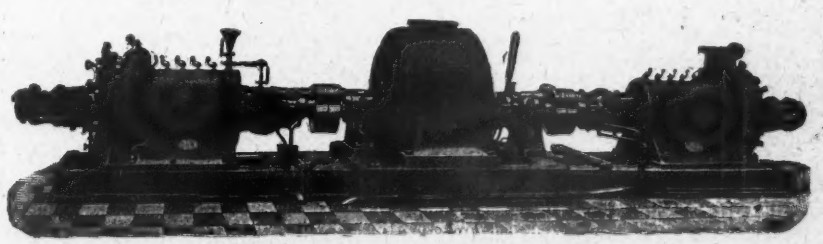

Fig. 3.—Double-Ended High-Lift Mine Pump.

Sinking pumps with vertical shafts, boiler feed pumps, &c., are included in the series.

## Rubbing-Contact Electric Bell.

There are few devices so simple, satisfactory and reliable as the common trembling bell; yet this has one weak point—the contact breaker—and many a failure to respond to the "push" has been due to dirty contacts. The ordinary pattern, with the contact spring mounted on the armature, might have been designed expressly to avoid rubbing of the contacts, so effectually does it attain this end; in the type here illustrated, however, the bell is fitted with the Julius Sax rubbing-contact, which, as will be seen at once, by an extremely simple device, ensures that whenever contact is made the fixed and moving contacts shall rub over one another and thus clean the surfaces. These contacts are fitted to the highest quality bells made by Messrs. Julius Sax & Co., Ltd., of 24A, High Street, New Oxford Street, London, W.C.

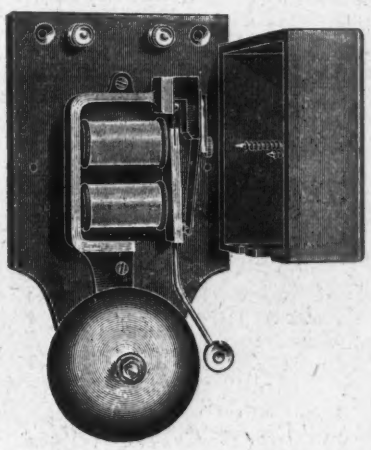

Fig. 2.—Bell fitted with Rubbing Contact.

## New Simplex Radiator.

Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have recently introduced a combination electric radiator and humidifier.

This is intended to get over the uncomfortable drying of the air liable to be experienced with every form of heating unless a high rate of ventilation is arranged for. Our illustration shows the water tank in section, at the back of the radiator lamps, by means of which sufficient moisture is imparted to the air without resorting to such an amount of ventilation as would impair the efficiency of the heater.

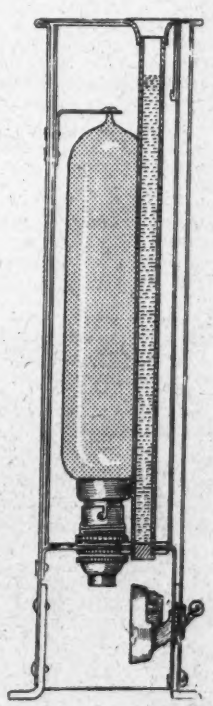

Fig. 4.—Sectional View of Simplex Combined Radiator and Humidifier.

The electric radiator takes no oxygen from the air, and with this form of heater the ventilation may be adjusted to the amount required by the occupants of the room.

## Boiler-Feed Disk Water Meters.

An interesting type of meter for hot water has been introduced by Messrs. Siemens Bros. & Co., Ltd., of Caxton House, S.W.,

which, it is claimed, ensures reliable operation, even in the case of very high feed-water temperatures, and is noteworthy in that owing to the use of graphite for the rubbing and sliding parts, lubrication of the moving parts is unnecessary. The construction of the meter is shown in the accompanying illustration (fig. 5). A hollow metal disk, resting on a ball and socket joint, is enclosed in a chamber, the form of which is determined by the peculiar movement of the disk. The disk, which divides the measuring chamber into two equal parts, takes its bearings on the lower and upper ball surfaces. The inlet and outer ports are arranged close together

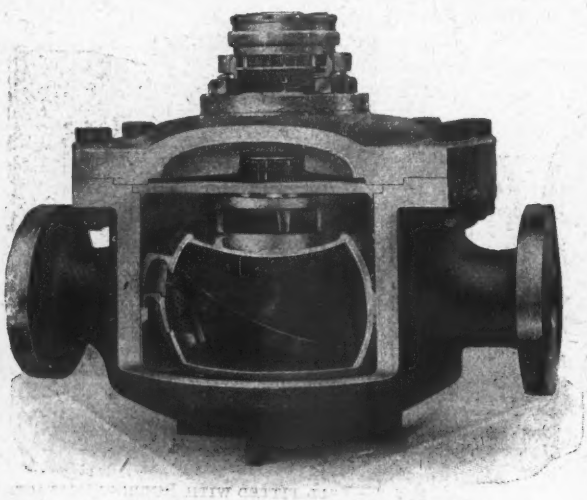

Fig. 5.—Boiler-Feed Disk Water Meter.

and are separated from one another by a vertical wall, running from the circumference to the centre of the chamber. This wall engages a corresponding slit in the measuring disk and prevents the disk from revolving around its vertical axis, and the water from passing through the measuring space without acting upon the disk.

In passing through the measuring chamber the water takes a certain definite course, setting the disk in motion, and with every nutation of the disk, a definite quantity of water—dependent upon the size of the chamber—leaves the meter, as in a piston pump, in which one complete charge leaves the cylinder during one movement of the piston. The quantity of water passed through the meter is read off the dial, which is similar to that of a gas meter.

### A New Tube-Bending Machine.

The Wardle Engineering Co., of 196, Deansgate, Manchester, are supplying the "Skolz" patent pipe-bending machine for the cold bending of gas, steam, and hydraulic piping or solid round bar—such as is used in reinforced concrete work.

This machine is shown in fig. 6; it consists merely of a framework carrying a bending block moved by a screw, and a couple of

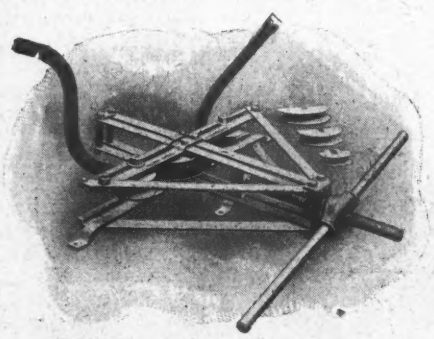

Fig. 6.—The "Skolz" Tube Bender.

guide pulleys, and it can be laid on a plank or bench and worked by a man or youth.

The machine is made in three sizes, covering tubes of from ½ in. to 2 in. bore.

The Wardle Co. also supplies "Skolz" iron cement—a metallic-iron powder—which, when mixed with water to the consistency of putty, can be used for filling defective castings, making joints, &c., in heaters, tanks, pipes, and electric tramway standards, and sets with metal-like hardness.

### Mazda Traction Lamps.

In our notice of these lamps last week the sizes in which they are made were incorrectly stated. They should have been:—20 c.p. 25 watts, and 30 c.p. 40 watts.

## OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"Remuneration" writes:—"We received in 1909 and 1910 instructions to draw up specifications and obtain estimates for putting a certain installation into order (there having been complaints for several years), and instructing us to use up old materials. We obtained estimates, using old materials, but stated that it would be rather a patched-up job, and thereafter were told to get estimates for complete renewal, which we did.

"The question of building a new boiler house then cropped up, and of renewing the whole work on a basis hitherto not feasible, and we drew fresh specifications, plans, &c., for this, and got tenders. The works did not go on.

"We charge 3 per cent. on lowest of estimates in each of the three cases—plus expenses, plus reports, and plus other things.

"Our clients state that we are not at liberty to charge on 3 per cent. basis—nor to receive remuneration on basis of any percentage on estimated costs, and quote 'Farthing *v.* Tompkins, 1893, 9 T.L.R. 566.' They say our fees should be settled on principle of *quantum meriut* in view of works not being carried out. How is that to be arrived at? We know of no custom or rule. Our clients referred to constitute three eminent lawyers. We should like to know whether there are cases where the Courts have passed the 3 per cent. basis.

"The question seems to be of interest to the profession, and while we are not on unfriendly terms with our clients, we should like to know what is customary and what is correct."

*** The statement that clients are not bound by the 3 per cent. scale is probably correct. It was decided in Farthing *v.* Tompkins (*supra*) that an architect was not entitled to recover commission (claimed on the amount of the lowest tender) on the estimated expense of a building never, in fact, erected, as that would include payment for supervision of the works, but he was allowed remuneration for plans, specifications and working drawings, and quantities taken out by him. A claim for a definite fee, like 3 per cent., must be founded either on agreement or on universal well-recognised custom; and it is anticipated that "Remuneration" would hardly assert that there was any such custom in his profession. What is known as "Ryde's scale" for the payment of architects in relation to building contracts has often been discussed in the Courts, and although in particular cases it may be held to be applicable, it is not always so. Each case must depend on its own peculiar facts. (See Stenning *v.* Mitchell, "Emden's Building Contracts," fourth edition, page 661). In the circumstances, it is probable that the view of the "three eminent lawyers" is correct.

"Esco" asks:—"Where a gas company and an electricity company are supplying in the same town, if the electricity company obtains the contract for the whole of the public lighting, can it compel the gas company to supply gas (on reasonable terms) to certain street lamp-posts which it would not be profitable to supply with electricity, or which are not in the neighbourhood of the electricity supply mains?"

*** It would be interesting to see the form of contract under which the electricity company above referred to has obtained powers. Indeed, it is not easy to answer the query without access to that document. Sec. 24 of the Gas Works Clauses Act, 1871, provides that gas undertakers must supply gas to any public lamps within the distance of 50 yards from any of the mains of the undertakers in such quantities as any road authority within the limits of the special Act may require to be supplied. It is not clear that the road authority has any power to delegate the right to make this requirement. Moreover, by Sec. 29 of the Electric Lighting Act, 1882, it is provided that in cases where a supply of electricity is authorised in any area, and within such area gas undertakers are under any limited or general obligation to supply gas on demand, the Board of Trade may, upon the application of the gas undertakers, make inquiry, and if they are satisfied that the supply of gas in that part has ceased to be remunerative, and that they should be relieved from the obligation to supply gas on demand, may make an order granting relief, either wholly or in part, and upon such terms and conditions as they may think proper, and from and after the date of such order, the gas undertakers are relieved. Whether this power would be exercised by the Board of Trade in the case suggested it is difficult to say.

**New Brazing Flux.**—Messrs. Southern Automobiles, Ltd., of Westcombe Hill, Blackheath, S.E., have brought out a new flux for brazing cast-iron under the title of "SA Brazing Flux." One of the features claimed is that this flux will carry the spelter into the minutest cracks; also it is not vital that the surfaces of the fracture should be perfectly clean, although it is advisable where possible. The flux leaves very little scale behind it, and what there is will be found quite soft and easily removed. The makers offer to send a small sample of repair work to any of our readers who are interested, and also to advise on any class of cast-iron repair, if the parts are sent to them carriage paid. It is stated that the cost of a repair using this material will be very much less than the present rates charged for this class of work.

## PARLIAMENTARY.

### Government Department Contracts.

A RETURN has been prepared of all contracts made in the United Kingdom for manufactured articles by the several Government Departments in the years ending March 31st, 1910, and March 31st, 1911, respectively, either with contractors outside the United Kingdom or with contractors or agents who obtain the articles from abroad. The following are amongst the contracts so made :—

| | 1909-10. | 1910-11. |
|---|---|---|
| THE ADMIRALTY. | | |
| Apparatus, wireless telegraphy ... | £1,236 | £5 |
| Carbons ... ... ... ... | 184 | 220 |
| Cells, dry ... ... ... ... | 438 | 2,806 |
| Drills, electric... ... ... ... | — | 67 |
| Fuses ... ... ... ... ... | 108 | 5 |
| Lamps, arc ... ... ... ... | — | 280 |
| Plugs, ignition ... ... ... | 53 | 72 |
| WAR OFFICE. | | |
| Aluminium ... ... ... ... | £683 | £1,061 |
| Wireless telegraphy apparatus ... | 104 | — |
| Carbons, electric lighting ... ... | 1,490 | 209 |
| Coils, porcelain ... ... ... | 141 | — |
| Copper ingot ... ... ... ... | 108,200 | 120,276 |
| Electric fans ... ... ... ... | 40 | — |
| Motors, dynamos & boosters ... | — | 7,019 |
| Plant, electrolytic ... ... ... | — | 2,278 |
| Telephones ... ... ... ... | 67 | 60 |
| POST OFFICE. | | |
| Telephone Exchange installations & telephonic apparatus ... ... | £6,871 | £21,744 |
| Telegraphic apparatus of various sorts... ... ... ... ... | 531 | 244 |
| Fire alarm apparatus ... ... | — | 300 |
| Electric light apparatus and fittings | 1,595 | 483 |
| Carbons—Electric light ... ... | 587 | 682 |
| Ebonite goods... ... ... ... | 2,237 | 1,081 |
| Bimellac wire... ... ... ... | 213 | — |
| Tin ... ... ... ... ... | 2,365 | 1,597 |
| Spelter and zinc ... ... ... | 142 | — |
| Motors—Electric and parts ... ... | — | 102 |
| Tools ... ... ... ... ... | 234 | 402 |
| Cells, dry ... ... ... ... | 12 | 24 |
| Eburine insulators ... ... ... | 84 | 50 |
| Ambroin insulators ... ... ... | — | 79 |
| Lightning projectors ... ... | — | 562 |
| Measuring and testing apparatus ... | 135 | 104 |
| Cable terminals ... ... ... | — | 503 |
| Steel ... ... ... ... ... | — | 179 |
| Wax heaters, electric... ... ... | 21 | 167 |

**Petitions.**—The following are amongst the petitions which have been deposited against Bills originating in the House of Lords :—

Brighton Corporation.—Hove Corporation; British Electric Traction and others; Portslade, Shoreham and Southwick Urban District Councils.

Brighton District Tramways.—Hove Corporation and the Portslade U.D.C.

Brighton, Hove and District Railless Traction.—Hove and Worthing Corporation; British Electric Traction Co.; Shoreham and Southwick U.D.C.'s; and Steyning R.D.C.

Hove Corporation Railless Traction.—British Electric Traction Co; and the Portslade, Shoreham and Southwick U.D.C.

London and North-Western Railway.—The North Metropolitan Electric Power Supply Co.; Midland Electric Corporation; St. James' and Pall Mall Electric Light Co.; Kensington and Knightsbridge Electric Lighting Co.; Lancashire Electric Power Co.; companies supplying electrical energy in, and in the neighbourhood of, the Administrative County of London; Yorkshire Electric Power Co.; and 52 other petitions, including a large number of local bodies and gas companies.

North Ormesby, South Bank, Normanby and Grangetown Railless Traction.—North-Eastern Railway; North Riding County Council; and Cleveland and Durham County Electric Power Co.

**Trackless Trolley Systems.**—Mr. Pirie asked the President of the Board of Trade if the attention of the Government had been drawn to the growing necessities, especially in country districts, for an increase of facilities for the promotion of trackless tramways; if he could state the number of Bills and Provisional Orders respectively that had had to be promoted through the House of Commons for this purpose; what was the total cost of such promotion; and if, in view of the fact that such tramways required no more erection than the establishment of telegraph or telephone lines along the road, which connection the telephone authorities were permitted to put up without having to come to this House, the Government would consider the desirability of leaving this matter within the hands of the local authorities by authorising direct communication with the Board of Trade in order to obtain the necessary sanction. Mr. Buxton, in reply, said that during the last three Sessions 24 Bills or Orders were promoted for the purpose of authorising the running of cars on the trackless trolley system, and 12 Bills or Orders for the like purpose were being promoted this Session. Of the 24 schemes, 8 only had been sanctioned by Parliament. He had no information as to the total cost of promotion which had been incurred. The question of facilitating trackless trolley schemes had been under the consideration of the Board of Trade, and he hoped to be able to introduce legislation on the subject.

**Second Reading.**—In the House of Commons on February 21st the Ramsbottom Urban District Railless Traction Bill was read a second time.

In the House of Lords on Tuesday the following Bills were read a second time :—Hove Corporation Railless Traction Bill; North Ormesby, South Bank, Normanby, and Grangetown Railless Traction Bill.

In the House of Commons on Tuesday the following Bills were read a second time :—Bognor Gas Light and Coke Co. (Electricity) Bill; London Electric Railway Bill.

## BUSINESS NOTES.

**Bennis Contracts.**—We have received a lengthy list of contracts for stokers and coal and ash handling plant recently received by Messrs. Ed. Bennis & Co., Ltd., of Little Hulton and London. They include the following :—

Balfour, Williamson & Co., London, E.C. (for Chili).—Six stokers and self-cleaning compressed air furnaces; gravity bucket conveyor for feeding four boilers.

The North-Eastern Steel Co., Ltd., Middlesborough.—Two stokers and self-cleaning furnaces.

Steel, Peech & Tozer, Ltd., Rotherham.—Six stokers and self-cleaning furnaces. Repeat order.

Admiralty Dockyard, Chatham (Electric Light and Power Station).—Four chain grate stokers. Repeat order.

Corporation of Stoke-on-Trent, Electricity Station, Hanley.—Two stokers and self-cleaning furnaces. Repeat order.

Technish Bureau Voor Economische Stoomproductie, Rotterdam (for De Suikerraffindery, Amsterdam).—Two high-duty coking stokers on chassis for Stirling boilers.

The Bradford Colliery Co., Ltd., Manchester.—Two colliery furnaces for hand-firing. Repeat order.

The Tinsley Park Colliery Co., Ltd., Tinsley Park, Sheffield.—Two hand-firing furnaces (self-cleaning).

Tetlow Bros., Hollinwood (for the Ashton-under-Lyne Corporation Electricity Works).—Three bucket elevators for feeding three boilers.

T. Docwra & Son, London (for the Alexandria, Newport and South Wales Docks Power Station).—Coal bunker for four boilers.

S. Cutler & Sons, Ltd., London (for Amsterdam Municipality).—Two rotary truck tipplers suitable for dealing with Continental railway trucks, varying in capacity from 10 to 20 tons each.

**Catalogues and Lists.**—MESSRS. WARD & GOLDSTONE, Springfield Lane, Salford, Manchester.—36-page catalogue containing information relating to a great variety of electrical accessories for the motor-car and garage. This is a profitable department of business which it is felt the electrical contractor has not cultivated so zealously as he might have done, otherwise it would not have got so largely into the hands of general automobile firms. Messrs. Ward & Goldstone have specialised for the last eight years in the application of electrical appliances to the car, particularly the electric lighting of the car and charging appliances for the garage; therefore, their catalogue, with its various supplements, one of which is devoted exclusively to a system of electric car lighting, and lamps, batteries and accessories used in connection therewith, should be of considerable service. The contents of the catalogue include accumulator charging equipments, the "Hydranamo" system of accumulator charging from the cellar water-tap, the "Primax" battery, circuit-breakers, ignition coils and batteries, meters, inspection and test lamps, "Sampson" car lighting sets, switchboards, motor-car switches, interior lamps, side and head lamps, wires, spark plugs, &c.; also the "Sherbourne" petrol engine and dynamo, the "Sampson" electric lighting and charging set, the "Colonial" combined plant, and so forth. One of the supplements enters into the "Sherbourne" engine more fully, and the other contains a description of the "Facile" electric car lighting set, the Radiant electric lamps, car lighting accumulators, electric side lights, &c. Loose accompanying lists relate to "Metallum" lamps (prices); "Multex" pocket and portable hand-lamps; "Auto-Metal" accumulator and battery lamps; and the "W. & G." electric vulcanizer. The small lighting plants listed are with two-cycle type engine, which the firm early introduced for electric lighting purposes. During the last five years they have sold many hundreds of these sets in the Colonies for bungalow, farmhouse and similar purposes, and many for use in England. Copies of the catalogue will be sent to interested firms on application.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., Cheston Road, Aston.—16-page catalogue, No. M275, in which are given brief descriptions, together with illustrations and tabulated particulars including prices, of the following :—"Vickers" motor starters, open, semi-enclosed and water-tight types; Vickers combined motor starters and shunt regulators, single and double automatic types; motor control panels of open, semi-enclosed and water-tight types. Dimensions are tabulated at the end. All sizes of open and semi-enclosed starters are held in stock.

MESSRS. UNION ELECTRIC CO., LTD., Park Street, Southwark, London, S.E.—A batch of small mailing cards used by the firm for enclosure with correspondence has been received. Each of them

gives an illustration, brief notes, and prices of one or other of the following :—D.C. motor-generators ; cell-testing voltmeters ; a combined ohmmeter and generator ; knife switches ; water-tight rotary switch ; mining switchgear ; and searchlights.

The Indestructible Cable Co., 20, High Holborn, London, W.C.—16-page catalogue containing illustrated particulars of their several classes of copper wires and cables with "indestructible" insulation, a number of pages being devoted to tables of code-words, diameters, weights per mile and prices. The last few pages are devoted to particulars of bronze wires for telegraph and telephone wires, soft copper wires for bells, copper and iron binding wires. Copies of the list will be sent on application.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—A new folder has been issued, giving particulars of the "Gral" metal-filament lamps and a table of prices for lamps, ranging from 25 to 260 volts and 7·2 to 90 c.p. Quantities of these folders are being supplied to the trade, overprinted, for distribution among consumers.

The Electrical Power Engineering Co., Stechford, near Birmingham.—Circular containing tabulated particulars and prices of their standard D.C. dynamos and motors, enclosed ventilated and totally enclosed, for from ½ to 10 H.P., also starting switches, &c., for same.

Messrs. Cox-Walkers, Ltd., Darlington.—Leaflet giving particulars and prices of the "C.W." new pattern electric lamps for motor-cycles and cars.

The Western Electric Co., Ltd., North Woolwich.—Small pamphlet (No. 107) of 16 pages, containing full instructions for installing their Westophones, Interphones, and single-line telephones, with about a dozen useful diagrams.

**Hydro-Electric Contracts.**—A large number of orders have recently been booked by Messrs. Jens Orten-Boving & Co, London, including the following :—

Water Turbines.

Trenton, Canada.—Four twin vertical turbines, 1,200 H.P., 18-in. head, 122 R.P.M. each, with governors.
Drawin & Milner, Sheffield.—One turbine, 100 H.P., 15 ft. head, 200 R.P.M.
City of Worcester, England.—One vertical double Francis turbine.—9½ in./14 in. H., 285/450 B.H.P., 125 R.P.M.
Shibaura Engineering Works, Hachiman Hydro-Electric Co.—One Francis turbine, 200/220 H.P., 17-ft. head, 230 R.P.M.
Hydro-Electric Power and Metallurgical Co., Ltd., Tasmania.—Two impulse wheels, 5,000 H.P., 1,000 ft. head ; two exciter wheels, 180 H.P., 1,000 ft. head.
Indian Government, hydro-electric plant.—Three high-pressure turbines, H = 510 ft., 450 H.P.

Pipe Lines.

Hydro-Electric Power and Metallurgical Co., Ltd., Tasmania.—Two H.P. pipe-lines, 960, 850 and 750 m/m internal diameter, with H.P. muff joint, about 4,650 ft. long, maximum static head 1,120 ft.
Indian Government, hydro-electric plant.—Three welded pipe-lines, 16-in. diameter, 1,950 ft. long, &c.

Pumps.

Willans & Robinson, Ltd., Queensland Railway.—One circulating pump, 1,700 G.P.M., 114/124 ft. head, 1,740 R.P.M., with spares.
The Tata Iron Works Co., India.—One electrically-driven Victoria turbo-pump, 750 G.P.M., 573 ft. head, 1,450 R.P.M., 184 B.H.P.
Yates & Thom, Ltd., Blackburn.—One centrifugal pump, 600 G.P.M., 635 R.P.M., 28 ft. head.
Körting Bros., Ltd.—One Victoria low-pressure turbo-pump, 3,000 G.P.M., 50 ft. head, 730 R.P.M.

**Belgium.**—A new company has just been formed in Brussels, with a capital of £58,000, and the title Le Lift Compagnie Générale de Construction Mecanique et Electrique.

**Mordey-Fricker Electricity Meters.**—We understand that the British Insulated and Helsby Cables, Ltd., who have hitherto manufactured these meters for the Mordey-Fricker Electricity Meter Co., Ltd., have also made arrangements to take over the sales business in these instruments.

**Annual Dinner.**—On the evening of February 23rd the staff of the Anchor Cable Co., Ltd., held their eight annual dinner at the White Horse Hotel, Leigh, when about 32 members and friends sat down. After dinner a smoking concert was held, presided over by Mr. James Callender. Mr. J. Bowyer, the works manager, proposed the toast of the evening, "The Anchor Cable Co., Ltd.," to which Mr. Callender replied. In the course of his remarks, Mr. Callender said that the past year had been the most successful in the annals of the company. He complimented the whole of the staff on the way in which the work of the year had been carried through, and on behalf of the company thanked them all heartily for their efforts. Mr. Arthur Crooke proposed the toast of the guests, to which Mr. Lang suitably responded. The concert was provided by Mr. Walter Darlington's party, consisting of Messrs. Sumner, Allred and Reason, who rendered songs, duets, and humorous sketches.

**Trade Announcements.**—Mr. A. H. Finch and Mr. A. Imeson, late managing directors of Imeson, Finch & Co., Ltd., have ceased their association with this firm, and have commenced business as a private firm (Imeson & Finch, tramway contractors and manufacturing electrical engineers, Alma Chambers, Bridge Road, Stockton-on-Tees), manufacturing and supplying as before.

The business of Messrs. Nash & Smith, electricians, of 14, Cornwall Road, Walmer, Kent, has been taken over by Mr. Edward W. Smith.

Mr. Geo. Newby, electrical engineer, of Harrogate, has removed to new premises at 10, Prospect Crescent.

The Hart Manufacturing Co. announce that owing to increased business and the necessity for holding adequate stocks in London, they have taken over the adjoining building, thereby doubling the capacity of their premises. Their address is 76 and 77, Rochester Row, Westminster.

**Book Notices.**—The *Motor Manual*, 1912. London : Temple Press. Price 1s. 6d.—This is the fourteenth edition and the 200th thousand of an invaluable handbook, whose popularity speaks for itself. It is kept well up to date and rewritten when and where necessary, and contains an inexhaustible store of information on the subject of motor-cars. No owner should be without it.

*Motors and Motoring.* By Prof. H. J. Spooner. 5th edition. London : T. C. & E. C. Jack. Price 2s. net.—This is a very clearly-written account of the construction and characteristics of the petrol engine as applied to motor-cars and the management of the car in use. It is primarily intended for students, but is quite well adapted for the use of any person interested in the subject. It is very well produced, but the author has perhaps too freely availed himself of the system of emphasising words by printing them in bold-faced type. On page 227, for example, there are only eight lines in which this does not occur. Electric vehicles are only mentioned in passing ; but there is a good section on electrical ignition.

**Bankruptcy Proceedings.**—Thomas Topping, electrical and mechanical engineer, 361, Lord Street, Southport, Lancaster.—The adjourned public examination of the above-named debtor was held at the Court House, Government Buildings, Victoria Street, Liverpool, on Monday last, before Mr. Registrar Howarth. An opportunity is to be given the debtor to amend his statement. The Registrar said if he was informed by the Official Receiver that the amendment of the statement was in order he would close the examination, if not it would be adjourned.

Joseph Platt, electrical engineer, Bolton.—An order was made on January 17th suspending discharge for one year.

**For Sale.**—Messrs. Toplis & Harding will, on Tuesday, March 5th, sell by auction as a going concern the goodwill and business of the Langdon-Davies Motor Co., Ltd. Messrs. P. Huddleston & Co. will, on Friday, March 8th, sell by auction, at 298 and 300, Goswell Road, the entire stock and plant of Vaughan Engineering Installations, Ltd., (in liquidation). See our advertisement pages to-day.

**Dissolutions and Liquidations.**—Friend, Wintle and Co., electrical and general engineers, Quay Street, Cardiff.—Messrs. H. G. P. Friend and H. Wintle have dissolved partnership. Mr. Wintle will attend to debts, &c.

African Trans-Continental Telegraph Co., Ltd.—Creditors must send particulars of their debts or claims to the liquidator, Mr. P. J. Baird, 2, London Wall Buildings, E.C., by April 15th.

## LIGHTING and POWER NOTES.

**Accrington.**—On Tuesday a L.G.B. inquiry was held here by Mr. T. C. Elkin into the application of the Corporation for sanction to the borrowing of £33,750 for purposes in connection with the electrical undertaking of the Corporation, including the carrying out of work at Altham and Clayton-le-Moors. Mr. Gray, electrical engineer for the Corporation, gave a detailed estimate of the cost of the engines and generating plant necessary for the Corporation's requirements, and said the tenders had not yet been let. The Town Clerk said that, making reasonable allowances, the whole of the plant would be in use next winter. It was required for the supply of electricity to Clayton-le-Moors and for Altham, and for general extensions. Figures were given showing that the cost of gas plant would be £8,000, gas engines and generators £13,500, main switchboard £550, foundations, &c., £2,480. There was no opposition to the application.

**Acton.**—It was reported at the last meeting of the Council that certain matters were still in dispute in connection with the transfer of the electricity undertaking to the Metropolitan Electric Supply Co., whose solicitors' letter, making an offer of settlement, the chairman (Councillor Crane, J.P.) moved be referred back to the Committee, with an instruction that, unless the matter was settled forthwith, the Committee take the strongest possible action, either by applying to chambers for the naming of an arbitrator or the naming of an arbitrator between the two parties. It was suggested that the Committee conducting the negotiations was hurried and hustled by members of the Council, who were anxious that the undertaking should leave the Council's hands.—Councillor Page said the matter was hurried in order to help the rates for the current year.—The chairman said he was obliged to add that at the outset a letter was written by him, as chairman of the Council, to the late electrical engineer, warning him against allowing the company to have access to the papers or books of the undertaking without the consent of the Council, but that instruction was entirely disregarded.—The motion to refer back was agreed to.

**Australia.**—The Melbourne City Council is negotiating with the Brunswick and Port Melbourne Councils for supplying them with energy at £6 10s. per KW. of maximum demand and 7d. per unit.

The Sydney City Council has had under consideration the question of coal storage for the Council's power house. The engineer's estimate is based on 20,000 tons being required to meet

three months' consumption in five years' time, and this would necessitate obtaining 2½ acres of ground on which to store 12,500 tons of coal which could not be accommodated at the power house.

Tenders have been called for the erection of a 600-KW. generating plant on the banks of the Molongo River, N.S.W., adjoining the Federal capital site. High-speed engines and three-phase alternators with water-tube boilers are proposed, the cost being about £20,000. This plant will supply power and light for the contractors engaged on the work of building the City.

We hear from Mr. P. J. Pringle, that, in the case of the Ballarat and Bendigo undertakings of the Electric Supply Co., of Victoria, it has been decided to increase the price of electricity owing to the growing cost of working due to all-round increases of wages, &c. During the past 12 months the Ballarat private lighting revenue has increased some 50 per cent. and the consumers by 59 per cent.; the horse-power of motors installed and in hand has increased by 84 per cent. This represents 253 new consumers and 286 H.P. in motors. Mr. Pringle also refers to the withdrawal of free passes on the Ballarat and Bendigo tramways for the same reason as mentioned above. Nearly 200 passes are in circulation, 110 in connection with the police and the remainder divided amongst the members and officials of five municipalities.

**Argentina.**—The Rosario Municipality has resolved to throw out the two tenders received for public lighting. The Rosario Electricity Co. has presented a draft contract for approval, offering so supply current on very reasonable terms for a period of 25 years. This project will be taken into consideration by the Council as soon as it meets.—*Review of the River Plate.*

Work will shortly be commenced on the electric light station at Curuzu-Cuatiá. Mr. L. Bubbio, a local merchant, is the concessionaire.

**Aylesbury.**—The U.D.C. has passed the following resolution:—"That the Council, in the event of a prov. order for electric lighting being granted, and confirmed by Parliament, intend to carry out the powers conferred by such an order."

**Balderton.**—At a meeting of the P.C., a report was submitted by Mr. Dilley stating that negotiations with the gas company for a public supply having come to nothing, the Lighting Committee had considered the feasibilty of obtaining an electricity supply from Messrs. Simpson & Co.'s engineering works. The scheme proposed was an overhead system of cables with 75 lamps, 50 of 50 C.P. and 25 of 100 C.P., the estimated cost being £115 a year, equivalent to a rate of 2½d. in the £. A resolution was passed to submit the scheme for the approval of the annual parish meeting on March 25th.

**Bispham.**—The new electric light station is expected to be in full working order within the next fortnight. Already a large number of customers have been secured.

**Braunton.**—After a long period of waiting and uncertainty, Braunton, a large North Devon village, has been successful in providing an electric supply, which was formally opened a few days ago. The contractors were Messrs. Crompton and Co., and the engineer in charge was Mr. H. Trefusis. The original scheme for lighting the village is now complete, but there are still several extensions to be carried out. The public lamps will number 60, and are of 50-C.P. each. The lamps used are Osram metal-filament lamps, with pear-shaped globes. The cost of lighting by meter is 5d. per unit, and by contract, 8s. per annum, for each 32-C.P. lamp. Current for motors, &c., or heating will cost 2½d. per unit. The plant consists of a horizontal oil engine of 38 B.H.P. at 225 R.P.M. The dynamo gives an output of 25 KW. at 220-250 volts. The battery consists of 130 cells, having a capacity of 360 ampere-hours.

**Burnham (Somerset).**—The U.D.C. has signed an agreement by which the prov. order for electric lighting is to be transferred to a local company to be formed by Dr. Purves, of Exeter. The company is to pay the cost of obtaining the order, and the Council is to pay not less than £200 a year for street lighting.

**Burnley.**—The Accrington Corporation has promised that the charge for electricity for lighting purposes in Altham should be the same as in Accrington. The Burnley R.D.C., in whose district Altham is, decided to be represented at the L.G.B. inquiry at Accrington, so as to get that condition inserted in the Order.

**Canada.**—A report from the office of H.M. Trade Commissioner for Canada states that another company is maturing plans for operations on the north side of the St. Lawrence opposite the lower end of Grande Island. It is said that the company intends at first to generate 50,000 H.P. The company's capital is stated to be over £2,000,000.—*Board of Trade Journal.*

**Continental Notes.**—Sweden.—The Swedish Waterfall Authorities have recently placed an order with the Karlsbad Mechanical Works at Kristinehamn for the turbine plant of the Government's power station, which is under erection at Olfkarleby. The order comprises three turbines of 13,000 H.P. each, and designed for a fall of 16 metres and 150 R.P.M. The buyers have reserved the right of ordering two additional turbines of the same type and size, and at the same price per unit, before the end of 1913. The turbines are going to be installed in open chambers, and in regard to dimensions they are among the largest in the world. The consumption of water is estimated at 80 cb. metres per second, which is about 100 per cent. more than that of the turbines at Trollhätten. The order, which also comprises the oil pump and air-compressing plant, amounts to about £22,225.

Austria.—The municipal authorities of Kufstein are interested in a scheme for the establishment of a plant to utilise the water power of the river Weissacherache, in the Tyrol, in the generation of electrical energy for lighting and power purposes.

**Dewsbury.**—A petition has been lodged by the Corporation against the L. & N.-W. Railway Bill seeking power to supply electricity to works and other premises adjacent to its lines. The petition protests that the proposals in the Bill constitute an innovation in legislation, and submits that there is no justification for enabling the Railway Company to enter into competition with the Corporation.

**Dunoon.**—Following upon the receipt of the B. of T.'s intimation to revoke the Dunoon Electric Lighting Order (1906), a deputation from the T.C. visited London last week with the object of inducing the Board to reconsider its decision. It is learned that the deputation has been successful in its mission, and that the board has agreed to an extension for another year.

**Edinburgh.**—From a report by Mr. G. A. D. Mackay, inspector of cleansing and lighting under the Corporation, it appears there are 1,248 electric arc lamps in use for street lighting, and that the annual cost per lamp is £10. The stairs in the high tenements in the central parts of the city are now lit with electricity at a cost of 21s. each per annum.

**Falkirk.**—The burgh chamberlain and electrical engineer are to report on the necessity of further borrowing in connection with the extension of the electric light station.

**Keighley.**—The Borough Education Committee has decided to have the new Highfield School lighted by electricity.

**Liverpool.**—An interesting discussion took place at the Corporation meeting on February 21st, when the report came up for approval of the Electricity Committee's recommended reduction of electrical charges, particulars of which have already been published. Councillor Gates moved an amendment that the charges should be further reduced by 5 per cent., pointing out that by the £25,000 voted out of the profits of the electricity department in relief of rates, they were paying 10 per cent. of the prices received from the consumers. 10 per cent. profit on a Corporation undertaking was, he thought, excessive, and the first duty of an electricity Committee was not to make a profit, but to supply the public at a popular price. The only chance of the electricity undertaking getting on a sound footing was by renewing their plant without incurring fresh capital charges, instead of making profits. Councillor Max Muspratt said if the electricity concern was a public company money would be borrowed, no doubt, on debentures, which would not pay under 5 per cent. This undertaking, with the security of the ratepayers behind it, was able to borrow money at 3½ per cent., and the ratepayers had a perfect right to 1½ per cent., or something over £25,000 on their capital. It was a perfectly right and just charge, and the consumers had not the remotest claim to any of it. The amendment was lost, and the Committee's recommendations were agreed to.

The annual report of the Corporation superintendent of street lighting for 1911 shows that 6¾ miles of street in the city were lighted by electricity.

**London.**—Hackney.—A report has been received from Messrs. Preece, Cardew & Snell on the recommendations of Mr. Robinson, the borough electrical engineer, as to a scheme for extending the Council's electrical undertaking by means of three-phase H.T. plant. The report summarises the present position of the Hackney undertaking, showing that the present cost of energy at the station amounts to not more than £3·41 per L.T. KW. demanded, plus 0·355d. per L.T. unit generated. Offers of bulk supply from the neighbouring authorities of Stepney and Poplar are considered, both at £3 per KW. demanded, plus ·33d. per unit (H.T.) at their switchboards. These work out at £4·35 per KW. demanded, plus 0·379d. per L.T. unit and £4·2 per KW., plus 0·379d. per L.T. unit, respectively, delivered, for 1,500 KW., or more than the present cost to the Council. Mr. Robinson's scheme, with which Mr. Preece agrees, provides for three three-phase 3,000-KW. turbo-alternators, with boilers, &c., and a ring main supplying three sub-stations, each capable of dealing with 200-KW. maximum demand. The estimated cost is: Generating station, £116,000; H.T. mains, £25,000; three sub-stations, £32,250; L.T. sub-feeders, £22,944; total, £196,194. The station estimates summarised are as follows:—

| | £ | per KW. |
|---|---|---|
| Buildings, coal bunkers and handling plant ... ... ... | 34,000 | 3·77 |
| Boilers ... ... ... ... | 31,200 | 3·47 |
| Pipe work ... ... ... ... | 11,020 | 1·22 |
| Turbo-alternators and switchgear | 30,500 | 3·38 |
| Motor-generator, sundries ... | 9,280 | 1·03 |
| | £116,000 | 12·87 per KW. |

These figures, Mr. Preece says, are in agreement with others which his firm has obtained in the case of actual plants carried out. He suggests, regarding the duplicate ring main proposed by Mr. Robinson, that a single ring main with a duplicate diagonal main would prove sufficient for the purpose and cheaper. It is proposed to deal with the scheme in three stages, each one involving the installation of a 3,000-KW. turbine, and the first including a 1,500-KW. motor-generator to link up the H.T. and L.T. plant. The costs are:—Stage I: £64,700; Stage II: £30,300; Stage III: £21,000. A comparison of the estimated cost per KW. demanded in the case of extension of the Council's plant and of purchased supply is given for the years 1912-1919, and greatly favours the extension

of the local plant. Mr. Preece agrees with Mr. Robinson that there are disadvantages incidental to the purchase of a stand-by supply, but sees no reason why the three authorities—Hackney, Stepney and Poplar—should not at a later date link up for mutual help.

Battersea.—The General Purposes Committee has decided to retain counsel to appear in support of the Council's petition against the L. & N.W. Railway Bill in the event of the negotiations proceeding, with a view to an undertaking being given to meet the points raised on behalf of the Council, proving unsuccessful. In order to cope with the anticipated increased load, the Electricity Committee has compared terms obtained from the County of London Electric Supply Co. for the supply of electricity in bulk, with a scheme submitted by the electrical engineer, and has come to the conclusion that it would be more economical and satisfactory for the Council to install additional plant. Application is, therefore, to be made to the L.C.C. to sanction the borrowing of £8,768, the estimated cost of an additional turbo-generator set, with the necessary surface condensing plant, pipework, switchgear, and cables in connection therewith. In order to increase the efficiency of six boilers at the central station, five are to be fitted with superheaters and a mechanical stoker is to be fitted to the remaining one.

**L. & N.W. Railway Bill.**—We notice that decisions to oppose this Bill have been come to by West Bromwich, Doncaster, Worksop and Cardiff, in addition to others previously referred to.

**Lexden and Winstree.**—The B. of G. has decided to have the electric light installed in the workhouse, and to take current from the Colchester T.C., whose officials are to superintend the work. The installation will cost £139, and the annual cost will be £40 a year. The estimates for gas and petrol gas were both considerably higher for the installation, and, the annual cost of gas was £152, and of petrol gas, £30.

**Lytham.**—A petition is being extensively signed in Ansdell and Fairhaven districts for electric light to be supplied by St. Anne's Council. Before the request can be granted, however, permission will have to be obtained from Lytham Council, and St. Anne's Council will have to obtain the necessary powers.

**Newport (Mon.).**—On February 27th a L.G.B. inquiry was held relative to the application of the T.C. for aloan of £5,000 for electricity purposes.

**New Zealand.**—Tenders have been invited for the machinery, &c., in connection with the Lake Coleridge hydro-electric scheme. This includes a 7,000-ft. tunnel and 2,700-ft. of pipe lines leading to the turbines. Three 2,150-B.H.P. Francis turbines at 500 R.P.M., and a 225-B.H.P. Pelton wheel are to be installed, the latter for driving the exciter. This represents a first installation of 6,000 H.P., but the plant can be extended to 12,000 H.P.

**Peterborough.**—The Corporation has received a request for a supply of electricity for lighting All Saints' Church (Peterborough) and vicarage, as well as a number of residences in the same district. The Council at its next meeting will be asked to extend the mains to supply these, at an estimated cost of £492. The income is put at £58 from consumers, or, including street lighting £97.

**Port Glasgow.**—The T.C. has unanimously decided to abandon the proposed scheme for the installation of plant for electric lighting and power purposes. The question of further procedure has been remitted to the Electricity Committee for report to another meeting.

**Portrush.**—The Plebiscite Committee reported that the majority of ratepayers in favour of electric light was 38; 139 persons had promised to become consumers, 132 had refused to do so, and 157 had not answered that question. The report was adopted.

**St. Anne's-on-Sea.**—The net profits of the local electricity undertaking last year were £1,500. The petition of Ansdell householders to St. Anne's Council for a supply of current in the Lytham Urban District was considered by the Council on Monday; it was decided to institute certain necessary inquiries before proceeding further.

**Salford.**—The B. of G. has approved of a scheme for substituting electric lighting for gas lighting at the Hope Hospital at an estimated cost of £2,000.

**Slough.**—The U.D.C. has accepted the tender of the Slough and Datchet Electric Supply Co. for lighting the pumping station for a year at 6d. per unit for the first 80 units per quarter, and 3d. per unit beyond.

**South Africa.**—Messrs. E. H. Gellander & Co. have secured the contract for the lighting of Volksrust (Transvaal) under agreement with the municipality, and it is hoped to have the installation complete by September, 1912. The system is to be a three-wire D.C. one, with 460 volts across the outers. The municipality will take current at 6d. per unit for street lighting with carbon lamps, or 6½d. if metal lamps are used of not less than 50 C.P. each. The municipality guarantees to use 700 units per month for street lighting, based on 150 nights of six hours and 150 nights of five hours. The contractors will be allowed to charge private consumers at a rate not to exceed 1s. per unit, with a minimum of 5s. per month, and the municipality for its buildings at not exceeding 9d. per unit. The supply will be from sunset to sunrise. Meter rent will be 1s. per month. The agreement is for six years, on the expiry of which the municipality has the option of renewing the agreement or taking over the concern.

**Stockport.**—In consequence of the gasworkers employed by the Corporation striking work on Saturday, the town was threatened with a gas famine. In the evening the gas lighted thoroughfares were mostly in darkness, the electrically lighted streets, however, being illuminated. The gasworkers endeavoured to prevent the electric tramways from running. The strike was settled on Tuesday.

**West Ham.**—In order to provide for the more economical working of the No. 12 turbo-generator, it has been decided to provide a new condenser at a cost of £1,850, and application is to be made to the L.G.B. for sanction to borrow that amount.

**Willesden.**—The Lighting Committee reports having considered the question of the general lighting of the district. This lighting is at present effected by electricity and gas, 10 miles of streets being lighted by the former and 70 miles by the latter: the total cost of lighting per annum by the two systems being:—electric £3,038 and gas £7,294. The Committee has instructed the engineer to prepare a detailed statement of the lighting of every thoroughfare in the district together with the illuminating power of the lamps now fixed. In the meantime, he has been authorised to make arrangements for the lighting of Teignmouth Road and St. Gabriel's Road by electricity and gas respectively, and to obtain estimates from the Electricity Committee and the Gas Company to enable the comparative merits of the costs of the two systems to be ascertained.

**Worksop.**—The Council has approved of plans and estimates by the engineer, and decided to seek sanction from the L.G.B. to raise a loan of £7,280 for the following purposes:—Storage battery, &c., £1,750; condensing plant, &c., £1,050; mains and services, £3,740; mechanical stokers, addition to switchboard, &c., £391; contingences, £349—a total of £7,280. It will also make application to the B. of T. for sanction to the erection of overhead wires for the purpose of taking over all existing street lamps that remain lighted by gas, 54 in number.

## TRAMWAY and RAILWAY NOTES.

**Algeria.**—Plans are being prepared in respect of a projected electric tramway in the town of Constantine.

**Australia.**—Mr. Stone, the electrical engineer to the Railway Department, is coming to London to confer with Mr. C. H. Merz on the electrification of the Melbourne suburban lines, the traffic on which has materially increased since the original report was made in June, 1908.

Mr. H. R. Harper, as one result of his recent visit to Europe and America, has succeeded in inducing the Melbourne City Council to obtain a couple of electric-battery lorries for its own use.

Further reports on the Perth, W.A., tramways situation show that a discussion has taken place on the introduction of the motor-'bus, and that the purchase of 30 or 40 chassis, possibly from the London General Omnibus Co., is being considered. A speaker denied that these would be the discarded vehicles of the company, which, we have been informed, are in some demand in the Colonies.

The Executive of the Australian Tramway Employés Union recently officially announced that if the men's case were not called on for hearing in the Federal Arbitration Court in February, all the employés of private companies in Australia would go on strike. The men, it was stated, had informed the officers of the Union in the different States that they would take this action on their own account if the case were not heard at once.

**Baildon.**—At a meeting of the D.C. held on Tuesday, February 20th, it was reported that the proposals of the Bradford Corporation in relation to the tramway project met with the approval of the Baildon authority. The Council, it was stated, had expressed a desire for the Corporation to obtain the necessary powers, and it was willing to pay an annual rental for a period of 10 years. Fuller details of the project were considered in committee.

**Blackburn.**—At a meeting of the Corporation Tramways Committee on Monday, it was decided to recommend the T.C. to advance the wages of all drivers, conductors, and shedmen, ½d. per hour, as from the end of the tramway year, March 25th next. No application for an increase had been made.

**Brighouse.**—The Corporation has, by deputation, approached the Halifax Tramways Committee with a request that railless cars should be run by Halifax from the present terminus to the Sun Inn, Rastrick. The Halifax committee was of opinion that the proposal was impracticable, and the deputation then suggested that the Brighouse Corporation should extend its present system and lease the new line to Halifax. After it had been pointed out that such a scheme would have to obtain Parliamentary sanction, the matter was left for consideration by a small sub-committee.

**Coventry.**—By an award under arbitration, the price fixed for the purchase of the tramway company's undertaking by the T.C. is £202,132, this being the value as a going concern. The T.C. is ordered to pay the company the arbitration costs. The sum originally asked by the company was £315,760, and the three valuations made for the Council were £128,180, £133,063, and £130,678. A loan for the purchase money and costs (estimated at £5,000) has been applied for by the Council.

**Greenock.**—A proposal is under consideration for an extension of the tramways to the upper parts of the town. The railless system has been suggested.

**Huddersfield.**—At a meeting of the T.C. held on February 21st, it was reported that revised rates of pay and conditions of service proposed by the Electricity Committee had been accepted by the men employed at the Electricity Works. The proposals set forth that the hours worked should not exceed an average of 54 per week; that overtime be paid at the rate of time and a quarter, and that one week's holiday with pay be granted to all men employed in the department after 12 months' service. The wages varied from 5d. to 8½d. per hour.

**London.**—According to the *Times*, the London United Tramways Co. has agreed to sell its Chiswick power station to the L.C.C. for £220,000. A part of the company's system has for some time been supplied from the Lots Road power station, and presumably the forthcoming acquisition of the company's tramways in London by the L.C.C. has determined it to this course. The Chiswick station formed part of the original tramways scheme carried out by the late Sir Clifton Robinson, and is quite out of date judged by present day requirements.

**Newcastle-on-Tyne.**—At a meeting of the Corporation Tramways Committee on February 22nd, the estimates for the ensuing 12 months were presented by Mr. J. H. Rodgers. He said that last year the estimated income from all sources was £212,350, and he thought that before the end of March this would be increased by £20,000, making a total of £232,350. They estimated that for next year there would be an income of £223,900, which was actually £8,000 less than they would get this year. They estimated £20,000 for general expenses, an increase of £1,500 over last year, the principal reason being the larger amount paid in rates and income-tax. He pointed out that while in 1907 they paid the city £6,783 in rates, they now paid nearly £12,000. On general repairs and maintenance they estimated for next year an outlay of £25,000; on the power station an expenditure of £9,600. The public lighting expenses showed an increase of £4,200, with an expenditure of £123,800. Their gross surplus, if their estimates were correct, would be £100,000, but out of that amount for interest, redemption, and income-tax, £74,000 was needed, less £3,500 interest on money invested. After meeting other liabilities, the net profit was put down at £26,800. Mr. Rodgers submitted a list of streets where renewals would have to take place; these had been inspected by the City Engineer and tramways manager, and the cost amounted to £7,650. There were other places that should be renewed during the year, but the Committee hoped that they would be able to manage the work in the following year. If they were compelled to renew them, they would have to ask for money out of the reserve fund. It was decided to spend £17,836 on extra plant at the power station, thus making £25,486, which would have to be drawn out of the reserve fund. The chairman said that the last-named amount would have to be paid out of this and next year's profits to make the reserve fund what it was. The estimates were adopted.

**Preston.**—The borough engineer and tramways engineer have been instructed to prepare a scheme for the electric lighting of the tramway routes and the Corporation property. The question of improving the lighting of the various streets in the borough has been postponed pending further information.

**Radcliffe.**—During 1911, the number of car-miles run on the U.D.C.'s tramways was 290,054, and the receipts amounted to £10,556, or 8·41d. per car-mile, as compared with 284,990 car-miles, £9,832 receipts, or 8·28 per car-mile for 1910. These figures do not include the extension tramways (Ainsworth and Bury and Bolton Roads), on which there was a loss of £688 (as against £856 in 1910), which will, by agreement, be borne in equal shares by the Bury and Radcliffe Councils.

**Stalybridge.**—The Joint Tramways and Electricity Board has decided to obtain 30 Spencer mechanical brakes for use on the tramways.

**Turkey.**—A new water-power generating station is to be established by the Société des Tramways et Eclairage Electrique de Damas.

**York.**—The Light Railway Commissioners have acceded to the application of the Corporation for a provisional order authorising the extension of the tramways from a junction with the Dringhouses line in Blossom Street to a terminus near the back of the Grand Stand. The extension, which will be about a mile in length, 7 furlongs being double track, is estimated to cost £18,800.

## TELEGRAPH and TELEPHONE NOTES.

**Cheaper Cables.**—The P.M.G. recently stated that the Eastern Telegraph Co. had agreed to reduce the rate for Press telegrams of a non-urgent character to Cape Town and Durban from 9d. to 3½d. a word, as from to-day. He hoped that a reduction in the rate to India would also be effected shortly.

**Congo.**—The Budget of the Congo State for the current year contemplates the expenditure of 40,000 fr. for the installation of a telephone line, and 1,700,000 fr. for the establishment of a wireless telegraphic service.—*Elek. u. Masch.*

**East Africa.**—In his annual report on the development of the East Africa Protectorate for the year ending March 31st last, the Governor says that the total length of telegraph lines amounts to 1,016 miles of pole lines, of which 859 miles are erected on iron poles, and 157 on wooden poles. The mileage of wire amounts to 2,261. The length of telephone pole line is 60 miles, carrying 304 miles of wire. There are 300 telephones in use.

**Portugal.**—The Government has signed a contract with the Marconi Co. for the erection of stations at Lisbon and Oporto, in the Azores, at Madeira, and at St. Vincent. All the installations are to be completed this year.

**South America.**—The *Review of the River Plate* reports that a German syndicate has been buying up the shares of the Cia. Telegrafica-Telefonica, and will shortly obtain a controlling influence. The company will be formally turned over to the syndicate for about £100,000, which works out at about $230 per share. The syndicate represents the German Cable Co. touching at Fernando Noronha, and with the acquisition of the Argentine Co. it will extend its lines to Monte Video. We referred to this matter in our issue of February 2nd.

**Telegraphists' Hours.**—At a meeting of the London branch of the Postal Telegraph Clerks' Association on Monday last, a resolution was unanimously adopted protesting against the great increase in the late duties at the Central Telegraph Office, and the alleged disregard of the operators' comfort and convenience by the controlling officers.

**The Telephone Service.**—In reply to questions in Parliament, the P.M.G. recently explained that difficulties were experienced in connection with the transfer to new exchanges of the 5,150 subscribers and 1,950 junction circuits connected with the old Westminster and Avenue Exchanges of the company. These exchanges had to be vacated because their equipment was not of a modern type, and the leases of the premises were about to expire. He regretted the resulting inconvenience to subscribers, but believed that during the past three weeks great improvement had been made.

**Uruguay.**—Commenting on the decree of the Government that all ships conveying passengers to or from Uruguay shall be equipped with wireless installations from May 1st, the Monte Video correspondent of the *Times* suggests that as it is an unimportant and unattractive port of call, it is quite doubtful whether the result will not be that Monte Video will be omitted from the itinerary of ships not so equipped, instead of adopting the wireless system.

**Wireless Telegraphy.**—It is proposed that the French Government shall grant a sum of £10,000 to encourage the installation of wireless plant in fishing smacks.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" February 16th.

March 11th.—Electrical goods, for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (Form 26). Stores Manager, Aberaman Offices, near Aberdare.

**Aldershot.**—March 5th. Additions to main switchboard at the electricity works, for the U.D.C. Mr. F. Garside, electrical engineer, Laburnum Road.

**Australia.**—Victoria.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

April 2nd.—250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 23rd.

April 16th.—Magneto table telephones and common-battery wall telephones, and 500 three-position switching keys, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 23rd.—2000-kw. steam turbo-alternator, for the Melbourne City Council. See "Official Notices" to-day.

Western Australia.—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal.*

Paper-insulated, lead-covered cable and loading devices (Schedules 184 and 185), for the P.M.G.'s Department, Perth. See "Official Notices" February 23rd.

**Barrow-in-Furness.**—March 4th. Electrical and other stores, for the Electricity Department of the T.C. Borough Electrical Engineer.

**Birmingham.**—March 12th. Electrical stores, for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

**Brazil.**—April 18th. The General Direction of Public Works at Pernambuco is inviting tenders for the concession for the construction and working of a system of electric tramways in the town.

**Bulgaria.**—Gabravo.—Concession for the electric lighting of the city. Particulars from the Municipality.

Sofia.—March 15th. Telegraph and telephone materials for the Bulgarian Directorate General of Posts, Telegraphs and Telephones. Local representation.—*Board of Trade Journal.*

**Canada.**—Calgary.—March 20th. City Commissioners. One 2,500-kw. turbo-generator set, one 1,000-kw. synchronous motor-generator, 50-kw. motor-generator and 25-kw. exciter set. Deposit £500. Particulars can be seen at Board of Trade Commercial Intelligence Department in London.

**Croydon.**—March 11th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**Devonport.**—March 7th. Switchboard extension and one 1,000-kw. d.c. turbo-generator, for the Corporation. See "Official Notices" February 16th.

**Dover.**—March 5th. Electrical sundries, cables, &c., for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street. Schedules 2s. 6d. each.

**Dublin.**—March 6th. 5,000-volt, 100-kw., three-phase transformer pillars, for the Corporation. See "Official Notices" February 16th.

March 6th.—1,500-kw. polyphase alternator and dismantling and alteration of plant at the Pigeon House generating station, for the Corporation. See "Official Notices" February 23rd.

**Dundee.**—The T.C. Electricity Department invites tenders for the supply of general and electrical stores. City Electrical and Tramways Engineer.

**Edmonton.**—March 13th. Electrical supplies and lamps, for the B. of G. Mr. F. Shelton, Clerk, White Hart Lane, Tottenham.

**Egypt.**—March 18th. Supply of 340,000 sleepers to the Egyptian Railway and Telegraph Department.

**France.**—March 6th. The General Direction of the French Posts and Telegraphs (103, Rue de Grenelle, Paris) is inviting tenders for eight lots of telephone cable with 14 and 24 pairs of conductors.

**Glasgow.**—March 8th. Rotary converters and accessories, for the Corporation Electricity Department. See "Official Notices" to-day.

**Great Central Railway.**—March 5th. Stores and materials for a year. See "Official Notices" February 23rd.

**Heston and Isleworth.**—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" February 16th.

**Hornsey.**—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See "Official Notices" February 16th.

March 16th.—Extension of dynamo and feeder switchboard, for the T.C. See "Official Notices" to-day.

**Hoylake and West Kirby.**—March 7th. Two centrifugal pumps and a.c. electric motors, frequency 50, with automatic switchgear, for U.D.C. sewage pumping works. Engineer and surveyor, Town Hall, Hoylake.

The U.D.C. is also inviting tenders for an additional boiler and pump at the electricity station.

**Hungary.**—Rajec.—Installation of electric lighting. Particulars from the Municipality.

**Leeds.**—March 9th. 6,000-kw. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" February 16th.

**London.**—Battersea.—March 5th. One 1,500-kw. high-pressure steam turbine coupled to two 750-kw. d.c. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" February 16th.

Poplar.—March 4th. Telpher coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" February 16th.

St. Pancras.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

L.C.C.—March 8th. Electrical installation at the Victoria Embankment Gardens conveniences, Charing Cross. See "Official Notices" February 23rd.

Marylebone.—March 13th. Materials for a year, for the B.C. Electricity Department. See "Official Notices" February 23rd.

Southwark.—March 13th. Cable, for the B.C. Electricity Department. See "Official Notices" to-day.

**Manchester.**—March 13th. Two 650-800-kw. and one 750-kw. motor converters or rotary converters and static transformers, for the Corporation. See "Official Notices" to-day.

**Merthyr Tydfil.**—March 6th. Electrical accessories for a year, for the B. of G. Workhouse Master.

**Newport (Mon.).**—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

**New Zealand.**—March 27th. Public Works Department. Supply to Lyttleton, under the Lake Coleridge electric power scheme, of water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London.

**Nottingham.**—March 2nd. 350 tons of steel tramway rails and seven tons of tie bars for the Tramways Committee. Mr. A. Brown, city engineer.

**Rhodesia.**—March 4th. Electrical plant, for the Municipality of Salisbury. See "Official Notices" to-day.

**Rochdale.**—March 6th. Corporation Paving and Sewage Committee. Electrically-driven centrifugal pumping plant, at the Roch Mills Sewage Disposal Works. Specifications and forms of tender (£5, returnable) from Mr. S. S. Platt, borough surveyor, Rochdale. Tenders only considered from firms who have had experience with similar work.

March 7th.—(*a*) Two Lancashire boilers, with mechanical stokers and coal elevators; also economisers and extensions to pipework; (*b*) one three-phase motor alternator, for the Corporation. See "Official Notices" to-day.

**Roumania.**—March 11th. The municipal authorities of Constantza are inviting tenders for the concession for the establishment of a central electric lighting station and for the construction and working of a system of electric tramways in the town.

**Salford.**—March 11th. Stores, &c., for a year, for the Corporation Electricity Department. See "Official Notices" February 23rd.

**Siam.**—Bangkok.—March 15th. Electric power station with a capacity of 3,000 kw. For further particulars, see this column for November 24th.

**South Shields.**—March 6th. Supply of engine-room stores, hardware tools, carbons, lamps, &c., to the electricity works for a year. Mr. H. S. Ellis, borough electrical engineer, Mill Dam, South Shields.

**Spain.**—The municipal authorities of Monforte (province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years.

**Sunderland.**—March 5th. Steam turbine, 5,000-kw. alternator and condensing plant, for the Corporation. See "Official Notices" February 23rd.

**Swansea.**—March 6th. Turbo-alternators and condensing plant, for the Corporation. See "Official Notices" February 23rd.

**Sweden.**—March 31st. The Electro-technical Department of the Stockholm Municipality are inviting tenders for the electrical equipment of the water-power generating station at Porjus (Laponie). Tenders to "Förestandaren för Kungl. Vattenfallsstyrelsens Elektrotekniska Byra," Stockholm, whence also copies of the specifications may be obtained on deposit of 25 kronor (about 27s. 10d.), returnable on receipt of a *bona fide* tender.—*Board of Trade Journal.*

**Swindon.**—March 9th. Materials for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" February 23rd.

**Taunton.**—Single-phase transformers for the T.C. See "Official Notices" February 23rd.

**Warrington.**—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

**West Ham.**—March 9th. 5,000-kw. two-phase turbo-alternator, with condensing plant and two-phase E.H.T. switchgear, for the Corporation. See "Official Notices" February 23rd.

**Wolverhampton.**—March 6th. Stores, electrical, &c., for the Corporation Tramway Department, for a year. Mr. W. A. Luntley, general manager, Cleveland Road.

**Wrexham.**—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" February 16th.

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## CLOSED.

**Ashton-under-Lyne.**—The tender of Triumph Stoker, Ltd., Leeds, has been accepted for "Triumph" mechanical stokers for three new Lancashire boilers, 9 ft. diameter, for the Corporation electricity works.

**Belgium.**—The municipal authorities of Antwerp last week opened tenders for the supply of a quantity of submarine electric cables. Thirteen concerns tendered—eight German, two Belgian, and one each Austrian, French and English (the last-named being the British Insulated and Helsby Cables, Ltd). The lowest offer was that of the Rheydt Kabelwerk Gesellschaft, of Rheydt, Germany.

**Bristol.**—The Docks Committee of the T.C. on Monday accepted the tender of Messrs. G. E. Taylor & Co., of London, for cables, switchboard, and lighting in connection with the new shed and cold stores at the Royal Edward Dock.

**British Columbia.**—The *Liverpool Journal of Commerce* says that the British Columbia Electric Railway Co. is to construct, at a cost of a quarter of a million sterling, an additional tunnel to Lake Buntzen, and provide a separate generating station on the shore of the inlet, having a normal output exceeding 100,000 H.P. In this connection negotiations have just been concluded with the Caledonian Ironworks Co., Ltd., for three large water-wheels of the "double" pattern, each developing 14,000 H.P.; whilst to Messrs. Dick, Kerr & Co., Ltd., has been awarded the contract for electrical generators, each of 9,000-KW. capacity. "This equipment is to be ready for commercial service early next year. The competition for the work partook of an international character, tenders and designs being submitted by practically all the leading electrical manufacturers throughout Europe and America."

**London.**—The Metropolitan Water Board has accepted the tender of Messrs. Belliss & Morcom, Ltd., at £342, for the provision of engine and dynamo, &c., in connection with the extension of the electric lighting system at the Hampton Station.

ISLINGTON.—The B.C. has accepted the following tenders for the annual supplies to the Lighting Department :—

Engine-room stores.—James Gibb & Co., Ltd.
Arc lamp carbons.—Wm. Giepel & Co.; Sloan Electrical Co., Ltd.
Arc lamp globes.—Carl Quiltman.
Oils and lubricants.—Stern Sonneborn Oil Co., Ltd.
Transformers and accessories.—British Electric Transformer Co., Ltd.; Ferranti, Ltd.; Johnson & Phillips, Ltd.
Electricity supply meters.—Siemens Bros.; British Thomson-Houston Co., Ltd.
Cables.—British Insulated and Helsby Cables, Ltd. (for high and low-tension insulated cables on the sliding basis, and rubber-insulated cables on a fixed basis).
Electrical sundries, lamps, brushes, arc lamp parts, &c.—London Commercial Electrical Stores.
Metal-filament lamps.—Brimsdown Lamp Works, Ltd.
Electrical sundries.—General Electric Co., Ltd.
Brushes.—British Electrical Manfg. Co., Ltd.
Arc lamp parts.—A. Round.
Cable terminal, service and network boxes, tapes and iron castings.—Callender's Cable and Construction Co., Ltd.; W. Lucy & Co., Ltd.; British Insulated and Helsby Cables, Ltd.; Sykes & Sugden, Ltd.; J. Gibb & Co., Ltd.; Dussek Bitumen Co.; General Electric Co., Ltd.

**Newport (Mon.).**—The B. of G. on Saturday accepted the amended tender of the Neville Engineering Co. for an electric lift, at £280.

**Ocker Hill Power Station.**—The Midland Electric Corporation for Power Distribution have accepted the tender of the Brush Electrical Engineering Co. for a 3,000-KW. turbo-alternating set, with condensing plant and pipework complete.

**Norway.**—The Stavanger Electrical Works have recently, according to *Technisk Ugeblad*, placed an order with the Swedish Metal Works, of Vesteraas, for a new copper cable, at about £4,444, which is going to be laid between the electrical power station at Oltesvik and the electrical works at the town.

**Raasay Iron Mines.**—Messrs. Mirrlees, Bickerton and Day's tender, at £4,733, has been accepted for the supply of two four-cylinder Diesel oil engines coupled to British Electric Plant Co.'s alternators. Messrs. Brash & Russell's quotation of £450 has been accepted for supplying a high and low-tension switchboard.

**Rugby.**—The U.D.C. has accepted the tender of Messrs. Willans & Robinson, Ltd., for a Willans-Diesel oil engine and Victoria turbine pumps.

**Southend-on-Sea.**—The T.C. has accepted the following tenders :—

Brush Electrical Engineering Co., Ltd.—Four open-type trailer cars and accessories, for the pier tramway, £669.
Electrical Construction Co., Ltd.—Re-winding dynamo armature, £81.

**Stalybridge.**—The Stalybridge, Hyde, &c., Tramways and Electricity Board has accepted the tender of Messrs. Beeley and Sons for superheater and pipework.

**West Ham.**—The T.C. has accepted a quotation from the British Thomson-Houston Co., at £627 for the supply of switchgear required in connection with the supply of current to the Port of London Authority.

Messrs. Chamberlain & Hookham's tender for 50, 75, 100, 150 and 200-ampere A.C. meters for the T.C. has been accepted.

**Worcester.**—The City Education Committee has accepted the tender of Messrs. R. F. Morris & Co. for installing the electric light in Hounds Lane Schools, at £50.

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**Diesel Engine Manufacture.**—The *Pall Mall Gazette* says :—"Report has it that the Diesel Engine Co. is about to enter into an interesting and important scheme. . . . We understand that the project contemplated is an amalgamation of the interests of the Diesel Engine Co., Carels Bros., of Ghent, and a British firm, said to be Davey, Paxman & Co., of Colchester, the latter being well placed apparently for developing this particular class of business. Report has it that the capital of the combined undertaking will be £750,000, of which between £400,000 and £500,000 may be issued to the public, and about £100,000 or more will be held in reserve. . . . We understand that the system of licensing the manufacture to other firms, which has proved successful, and useful from the point of view of users, will be continued freely as before."

## FORTHCOMING EVENTS.

**Northampton Institute Engineering Society.**—Friday, March 1st. Paper on "Some Recent Developments in Electrochemistry," by Mr. E. L. Emtage.
Saturday, March 9th.—Annual dinner.

**Royal Institution.**—Saturday, March 2nd. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture II.)
Tuesday, March 5th.—At 3 p.m. Lecture on "The Optical Determination of Stress, and some Applications to Engineering Problems," by Prof. E. G. Coker. (Lecture II.)
Saturday, March 9th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture III.)

**London Association of Foreman Engineers and Draughtsmen.**—Saturday, March 2nd. At 8 p.m. At Cannon Street Hotel, E.C. Paper on "The Past, the Present and the Future Possibilities of the Internal-Combustion Engine," by Mr. W. P. Durtnall.

**Society of Engineers.**—Monday, March 4th. At 7.30 p.m. At the I.E.E. Paper on "The Trolley Vehicle System of Railless Traction," by Mr. H. C. Adams.

**Leeds University Engineering Society.**—Monday, March 4th. Paper on "Safety Devices applied to Apparatus used in Mines," by Mr. W. E. French.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, March 4th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Static Sub-station Equipment," by Mr. W. A. A. Burgess.

**Rontgen Society.**—Tuesday, March 5th. At 8.15 p.m. At the Finsbury Technical College. Demonstration of the Physiological Action of an Alternating Magnetic Field, by Dr. S. P. Thompson; and Demonstration of a Radiometer, by Mr. W. Hampton.

**Institution of Civil Engineers.**—Tuesday, March 5th. At 8 p.m. Papers on "Roller and Ball Bearings," and "The Testing of Anti-Friction Bearing Metals," by Prof. J. Goodman.
Wednesday, March 6th.—Students' visit to the Associated Portland Cement Manufacturers' Works, Swanscombe, Kent.

**Royal Society of Arts.**—Wednesday, March 6th. At 8 p.m. Paper on "Some Modern Problems of Illumination: The Measurement and Comparison of Light Sources," by Mr. T. Thorne Baker.

**Institution of Electrical Engineers (London).**—Thursday, March 7th. At 8 p.m. Paper on "Tariffs for Electrical Energy, with particular reference to Domestic Tariffs," by Mr. W. W. Lackie.

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## THE ELECTRICAL ENGINEERS
### (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, March 4th.—"A" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Tuesday, March 5th.—"B" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Thursday, March 7th.—"C" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Friday, March 8th.—"D" Company. Technical work and lecture on "Military Telephones," 7 to 10 p.m.
Saturday, March 9th.—Mobilization week-end run at Fort Coalhouse, Tilbury. The party will parade at Fenchurch Street Station (L.T. and S. Railway) at 3.10 p.m. Dress: Service dress, greatcoats, belts and haversacks; no arms will be taken.
Recruits' instruction.—Tuesday and Friday nights, 7 to 8 p.m.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

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**The British Electrical and Allied Manufacturers' Association.**—We have received the following report of a meeting of the Council of this Association, which was held at the offices, 36, Kingsway, London, W.C., on the 15th inst. There were present Messrs. A. B. Anderson, W. W. Blunt, F. R. Davenport, F. C. Gibbons, C. Koettgen, H. C. Levis, B. Longbottom, R. K. Morcom, F. H. Nalder, E. S. New, M. J. Railing, W. Rutherford, W. O. Smith, A. D. Williamson, and A. P. Wood. Mr. A. Bruce Anderson was elected chairman for the year, and he took the chair. The firm of James Howden & Co., Ltd., was elected a "Member" of the Association. The secretary reported the completion of the work of the Committee appointed to suggest amendments of the "Model General Conditions," and was directed to present same, after printing, to the Institution of Electrical Engineers. The secretary further reported that the Committee appointed to revise the Standards for Electrical Machinery (Report No. 36) has made considerable progress with this work. Representatives of the Association were appointed to the Engineering Standards Sub-Committee on Generators and Transformers, and also on the International Electrical Standardisation Committee. A Committee was also appointed to investigate and report to the Council the relations between the Electrical Trades' Benevolent Institution and the Association. Further consideration was given to the Electric Lighting Bill, 1911, and the secretary was instructed to communicate with the Electrical Contractors' Association in regard to the same. The secretary reported satisfactory progress of the following Sections: Dynamo and Motor, Engine, Meter, Telephone, Transformer, Heating and Cooking, Incandescent Lamp, and Switchgear Sections.

**Colliery Explosion.**—An explosion took place at the Powell Duffryn Collieries on Thursday last week; nearly 2,000 men were in the mine, but only three men were injured, and it is believed that the effects were thus limited by the efficient system of laying the dust in vogue in these pits.

## NOTES.

**Correspondence.**—Re Wakelin Bros.—We have pleasure in publishing the following letter, which has come to hand just as we go to press:—

"Our attention has been called to your report of the meeting of creditors and shareholders of Messrs. Wakelin Bros., Ltd., electrical engineers, 7, Tottenham Street, W., held on 16th inst., for the purpose of selecting a liquidator, &c. We act for Messrs. Fyfe, Wilson and Co., electrical engineers, 145, Bath Street, Glasgow, who are the sole agents for the sale of the Kelvin petrol sets, and it was through them that Messrs. Wakelin Bros., Ltd., secured the exclusive agency for the South of England, referred to in the report, in which it is said that 'the directors stated that the first set supplied through the company (our clients) proved to be defective, and involved the company in considerable expense.'

"This statement is quite untrue. Our clients delivered to the bankrupt company four generating sets in all. The first set delivered was for demonstration purposes only, and was stipulated to remain in the bankrupts' premises. They, however, without our clients' knowledge or consent, sold it, and obtained a price for it in excess of the invoiced price to themselves. As to the second and third sets, no question whatever arose. As regards the fourth set delivered, it was alleged by the bankrupt company to be defective in construction, but this was denied by the plaintiffs, and it was clearly proved that the defective condition of the set was due not to the set itself, which was properly tested before leaving the works, but to improper and faulty assembling in the fitting up, and for this Messrs. Wakelin Bros. were entirely responsible.

"This was the judgment of Mr. Justice Coleridge, who tried the case, and whose opinion is before us. It is true the bankrupt company pleaded a counterclaim in respect of expenses, &c., which they said they had incurred on account of the alleged defects. They failed to substantiate this counterclaim, and the judge entirely rejected it without even calling on our clients' counsel. Although the bankrupt company received full payment of the price of the whole four sets, amounting to over £400, our clients did not receive a single penny from Wakelin Bros., who retained the price of the sets as against their grossly inflated claim. The bankrupt company were found liable in the full costs of the action, but these, like the price of the sets, were not paid.

"It is clear, therefore, the cause of the bankruptcy must be sought elsewhere. You will appreciate that it is very misleading and calculated to be hurtful to our clients' interests that the report in this respect should be allowed to go uncontradicted, and we trust you will publish this letter in your next issue.

"Pinkerton & Sneddon, Solicitors, Perth.
"Agents for Fyfe, Wilson & Co.

"*February 28th*, 1912."

**The Coal Strike.**—As we go to Press the strike is already in progress in various parts of the Kingdom. The negotiations conducted by the Government have broken down, and by the time these lines appear in print, close upon a million miners will be idle. Electric light and power stations have, as far as practicable, laid in stocks of fuel which will enable them to continue service for some weeks ahead. Large numbers of workers in many departments of industry have already been thrown out of work or are under notice. Electrical manufacturers in the neighbourhood of London have coal supplies in some cases which will permit them to continue running their works for a month or two, but some will be obliged to shut down in a fortnight. Although at the time of writing there remain a few hours before all the miners' notices expire, the omens are most unfavourable, and a stoppage seems to be inevitable. In the interests of the entire nation let us hope that it will be of brief duration. We shall return to the subject next week.

**Fatalities.**—An inquest was held on Saturday last, at Dublin, into the cause of death of Henry Andrews, aged 36 years, who met his death on the previous day at the Corporation electricity works, Pigeon House Fort. According to the evidence of Mr. L. J. Kettle, deputy city electrical engineer, who was present at the time of the accident, the deceased was an engineer, or erector, in the employ of Ferranti, Ltd., and was engaged by them on the switchboard and cable work, carrying out a contract. He had been discussing certain switchboard work with witness. Witness had suggested that certain covers, part of the contract work, would be better on, and the deceased said he could put them on at any time. Witness warned him that all the switchgear was alive, being in use. Deceased did not proceed to do any work, not having even changed into his working clothes. He was standing in front of the switchgear, and touched part of the gear with his right hand. This gear was not alive, but suddenly he apparently reached out his left hand and touched a gear which was alive. Witness saw that he had received an electric shock, and immediately switched the current off. Artificial respiration was resorted to. A doctor was telephoned for, but the ambulance arrived first, and took the deceased to hospital. Deceased was a man of great experience, who knew as much about the work, if not more, than witness did. The warning would not have less effect on him than anyone else. The only work the deceased did that day was to put on covers, and there was no danger in doing that work. The jury returned a verdict of "Accidental death," and expressed their sympathy with the relatives of the deceased. Mr. T. H. Morris, secretary of Messrs. Ferranti, Ltd., also expressed the sympathy of the company with the relatives.

On Saturday last about 2,000 tons of coal, which had been stored by the City of London Electric Lighting Co., at Bankside, in anticipation of a coal strike, suddenly shifted, carrying before it a 10-ft. high retaining wall inside the works, which in turn fell on an outer wall 15 ft. high. Brickwork and coal crashed on to some houses in White Hind Alley, where a number of small children were playing. Some of them were overwhelmed, and two, four years of age, were dead when their bodies were recovered. The accident is attributed to the saturation of the coal in the heavy rainfall of Friday night last.

**Tungsten Lamps on Alternating Current.**—Extended tests have shown that there is no difference in the life of tungsten lamps on either alternating or direct-current circuits, the peculiar phenomenon of "off-setting" which occurs in tantalum filaments on A.C. circuits being absent. The effect of frequency on the performance of carbon and tungsten lamps is a matter of considerable interest, as carbon lamps cannot be satisfactorily employed on frequencies below about 40 cycles, unless the filaments are exceptionally thick. With filaments of the same size, the tungsten lamp is less liable to flicker than the carbon lamp on low frequencies, but this is not a practical condition, as the tungsten filament is always much smaller than a carbon filament of the same candle-power. We are informed, however, that tests made on Mazda lamps with drawn-wire filaments show that they will operate satisfactorily on frequencies of 50 and upwards, with filaments as small as that of the 15-watt 100-volt lamp, and on frequencies down to 25 cycles, in sizes not less than the 25-watt 100-volt lamp; the 40-watt 100-volt size, and larger sizes, it is claimed, are quite satisfactory on a 25-cycle circuit.

**Concerts.**—The staff of Messrs. Babcock & Wilcox, Ltd., held their fifteenth annual smoking concert on the 23rd ult., in the King's Hall, Holborn Restaurant. Mr. H. W. Kolle was in the chair, and in proposing the health of "The Firm," he welcomed the presence of all the directors of the company in England—with the exception of Mr. Knight, whose illness was greatly deplored—as well as some of the best known names in the engineering world. In replying to the toast, both Mr. Dewrance and Mr. Rosenthal referred to the threatened coal strike, and urged greater loyalty between workers and employers. The efforts of the numerous artistes engaged were greatly appreciated by the audience, which numbered about 700. Space does not permit us to give a detailed account of the programme, but special mention should be made of the delightful singing of Miss Annie Bartle, the beautiful flute solos rendered by Miss Edith Penville, the quaint humour of Mr. Walter Montagu, and Mr. Ernest Hastings's sketches at the piano. Votes of thanks to the chairman and to the committee brought a most successful evening to a close.

The fourth grand concert of the Metropolitan Electric Tramways Athletic and Social Club is to take place at the Alexander Palace on Thursday, March 28th. The band of the Metropolitan Electric Tramways always largely contributes to the programme for this annual event, and the evening is most enjoyable.

**Electrical Exhibition in Cornwall.**—It has been decided to hold an electrical exhibition in Cornwall in August next under the auspices of the Royal Cornwall Polytechnic Society, and the Society's diplomas of honour and diplomas of merit will be offered for trade exhibits and medals for inventions in electrical machinery and appliances. It is thought that, in view of the fact that several of the most important mines in the district are going in largely for electrical machinery, it should prove of mutual benefit to the mining industry and the electrical manufacturers if a successful exhibition could be organised. The exhibition will be held at Falmouth from August 26th to 31st. Mr. E. W. Newton is secretary.

**Canada.**—According to *Commercial Intelligence*, a new company with the title of Roper, Clarke & Co., Ltd., has been formed in Montreal to act as manufacturers' agents for the sale of electrical apparatus, machine tools, &c. The offices are at 141, St. Peter Street, Montreal. Mr. Roper was formerly manager of the Canadian General Electric Co.'s branch in Ottawa. The same journal states that "Mr. A. G. Chisnall, of the engineering staff of the Shawinigan Power Co., Montreal, has taken up an appointment with Messrs. Irving Smith, importers of electrical apparatus and machinery. Mr. Chisnall has been employed by several of the leading manufacturers of electrical plant in this country."

**Appointments Vacant.**—Shift engineer, for the Neath R.D.C.; works superintendent for the Oldham Corporation Tramways; sub-station charge engineer, for the Bristol Electricity Department (35s.). See our advertisement pages to-day.

**Electrical Trades Benevolent Institution.**—We are asked to announce that, another dinner having been fixed to take place on April 26th, it has been found necessary for this Institution to change the date of its annual festival dinner, which will now take place at the Hotel Cecil on Wednesday, April 24th. Mr. Ferranti has kindly consented to preside.

**To Prevent Smoke Nuisance in Australia.**—The Sydney City Council recently passed the following resolution:—"That with regard to a reference from Council of November 21st, 1911, as to whether Council should object to the establishment of any factory in the city boundary unless the motor power is electricity, representations be made to the Government with the object of obtaining an amendment of the Factories Act, so that no factory or industry to be hereafter established within a limited area of the city, to be hereafter fixed, shall be allowed to use power requiring combustion causing smoke."—*Australian Mining Standard.*

**Institution and Lecture Notes.**—Institution of Electrical Engineers (Manchester Section).—The annual dinner of the section was held on Friday last; the chairman, Mr. W. Cramp, presided; and there were about 130 members and visitors present.

After the loyal toasts had been duly honoured, Mr. W. Fox (past president of the Manchester Association of Engineers) proposed the toast of the "Institution of Electrical Engineers," and said that he had to offer its president, Mr. Ferranti, his congratulations upon the distinguished honour that had lately been offered him by the Vice-Chancellor of the Manchester University, viz.:—"The honorary degree of Doctor of Science." It appeared to him to be a crown of a very brilliant career, and whilst Mr. Ferranti might in future have great social honours conferred upon him, none could be greater than that now offered by the University, as it was the direct appreciation of his great work which had given him a world-wide reputation. He was informed that it was the aim of the president to induce the Institution to welcome commercial engineers as members, and that the Institution should take its place amongst the bodies influencing trade conditions in this country and in the Colonies, worthy objects of a worthy mind, and he heartily wished the president might bring them to a successful issue.

Mr. S. Z. de Ferranti, in reply, said they would be pleased to hear that the applications for new membership had very considerably increased; the transfers had also increased to such an extent that in the last quarter they had between two and three times the number that wanted to be transferred about a year previously. If the Institution was to be useful, it had to be strong and well off. Such an Institution could do good work by removing the obstructions and handicaps which, in many cases, had been placed in the way of our industry. Not long ago he tried to institute a campaign to further the idea of cheap electricity—1d. for domestic purposes other than lighting; but the Council thought it was rather a tall order to take up, and decided not to start such a campaign. But it was thought that good might be done by ventilating the subject, and with that view he asked Mr. Lackie to give a paper on the question of how they had introduced electricity so largely for domestic purposes in Glasgow, which would be read before the Manchester Section next week. It would be a most happy thing if the various engineering and scientific societies could keep more together and come more closely in contact. There was a great deal of overlapping. There was no branch of engineering that electricity did not enter into in some way, and what was wanted for the benefit and advancement of our branch was a perfect understanding with all other branches.

Mr. W. Cramp also replied, and said that, with regard to future policy, it seemed to him a mistake to ask the Institution of Electrical Engineers to follow what they might call the example of its older sisters—the Civil and the Mechanical Engineers. The I.E.E. had entirely different ground to cover. The I.E.E. had done what no other Institution had done, and that was to create throughout the country "Local Sections" which read their own papers, carried on their own discussions, &c. Both those Institutions would probably have to follow the I.E.E. He was sure the President and representatives of the Council present that night would not object when he said that in Manchester they sometimes spoke of the "London Section." They were not in Manchester disloyal, nor did they intend to be, but they were alive and sometimes were kicking. This kicking was a sign of good health, which he believed the President himself would not object to.

Mr. Alderman Walker proposed the toast of "Our Guests," and said it was useless for the designer and manufacturer to incorporate ideas unless there was a market to take them. Within a very few miles of that building he had that week seen groups of mills with 200,000 spindles, each with its own boiler plant, its own chimney stack and reciprocating engines; coal contracts had to be made, and arrangements for clinker to be removed. He ventured to submit that when the next mill-building boom came along such a crime as that would not be repeated. To-day there was a vast field for the electrical industry in Lancashire.

The Mayor of Salford replied, also Mr. H. N. Dunlop, secretary of the British Electrical and Allied Manufacturers' Association, who said his Association now comprised all the large electrical firms and a large number of the smaller firms, so that to-day it stood as an Institution representing the electrical industry of this country. There had been a considerable amount of discussion in various Institutions about the advantages of standards for electrical machinery. That was a problem which interested particularly the manufacturer, who was now trying to set his house in order.

During the evening musical items were given by Mr. Wilfrid Ludlow, which were highly appreciated by the company present.

Institution of Marine Engineers.—The adjourned discussion on the paper on "Auxiliary Machinery for Internal Combustion-Engined Vessels," by Mr. W. R. Cummins, took place on the 5th ult. In reply to the first part of the discussion, the author stated that British manufacturers of auxiliary machinery for the engine-room were as far advanced as their foreign competitors. After the discussion of the previous meeting, there did not seem much doubt that compressed air as a power transmission system was inferior to electricity in efficiency. Mr. W. P. Durtnall said the electric motor for auxiliaries when first introduced on board ship was not a mechanical engineering appliance, but to-day machines could be obtained, in the form of polyphase induction motors, that could stand comparison with any class of machinery. Mr. William Walker considered that it would be impracticable to have an oil engine for each unit of auxiliary plant, and thought that electricity was best, provided that suitable plant could be obtained for the deck machinery, and Mr. E. H. Evans cited instances where electrical machinery had been in use for many years in the Navy.

Illuminating Engineering Society.—On February 15th the annual dinner of the Society was held, Prof. S. P. Thompson, the president, being in the chair. Prof. R. S. Clay proposed "The Illuminating Engineering Society," which he said now numbered 330 members, including 120 corresponding members abroad, and was doing valuable work. Prof. Thompson, in responding, referred to the success of the Society in stimulating interest in the measurement of illumination, and in the efficient lighting of schools, workshops, &c., and said that much remained to be done. Mr. F. W. Goodenough proposed "Kindred Societies," remarking on the friendly relations which had been established by the formation of the Society between members of a number of Societies with apparently divergent interests. Mr. R. G. Shadbolt (president of the Institution of Gas Engineers) replied, and said that if the Society continued to progress as it had done in the past, gas engineers would be compelled to join it in much larger numbers. Mr. W. M. Mordey (past-president I.E.E.) also responded, pointing out that the Society covered a ground of its own, which could not be covered by any previously existing Society. Mr. R. J. Wallis-Jones proposed "Our Guests," and Dr. W. Garnett and Dr. F. G. Kenyon replied. Finally the toast of "The Chairman," proposed by Mr. L. Gaster (hon. secretary) was enthusiastically honoured and duly acknowledged.

Mr. Louis Rottenburg, one of the engineers of the New Transport Co., Ltd., was to deliver a lecture, on February 29th, to the Cambridge University Engineering Society, on "The Proposed London Goods Clearing House," with regard to its economic side, but more especially on the engineering details.

Institute of Metals.—The annual autumn meeting of the Institute of Metals will this year, for the first time, take place in London, in the last week of September. The next meeting will be the occasion of the third May lecture, which will be delivered on May 10th by Sir J. A. Ewing, on the subject of "The Inner Structure of Simple Metals." The corrosion investigation recently taken up by the Institute is now being actively pushed forward. The Corrosion Committee recognises the desirability of learning fully as to the experience of others on the subject of the corrosion of brass condenser tubes, and has had prepared a Corrosion Inquiry Form, which will be sent by the secretary to anyone interested.

At the annual general meeting of the Association of Technical Institutions last week, Sir. G. H. Kenrick was elected President for the ensuing year. In his presidential address on the subject, "Shall we teach Trades?" he said it was useless to expect discoveries in science to be applied to industries unless they had teachers who would make it their business to master these discoveries and explain them to the young people who were learning the trade. For the purpose of giving the training best suited to the trade, every trade should form its own Education Committee and give it plenty of money and plenty of discretion. Mr. W. M. Gardner, Principal of the Technical College, Bradford, maintained that it was impossible in these days for a lad to learn his trade properly in works. If the young man did not learn his trade at a technical school he never learned it at all; he became a mere machine, knowing only a portion of the work.—*The Times.*

**Annual Dinners.**—The West Ham Electricity Department.—The sixth annual dinner of the West Ham Electricity Department was held in the Connaught Rooms, Great Queen Street, on Thursday evening, the 22nd ult. About 150 members of the staff with their friends were present, and a very pleasant evening was passed. The borough electrical engineer, Mr. H. H. Couzens, was in the chair, and amongst others the Mayor (Alderman J. R. Hurry), and the chairman of the Electric Lighting Committee (Mr. Croot), were present.

After the usual loyal toasts, the health of the Mayor and Corporation was proposed in a felicitous speech by Mr. Gilbert, the mains engineer. In the double capacity of ratepayer and employee, Mr. Gilbert eulogised the manner in which the municipal work of the borough was carried on. The Mayor, in reply, pointed to the progress made by the electricity department, and mentioned that power was sold at a lower rate in West Ham than anywhere else. This had a great deal to do with the growing appreciation of the borough as an industrial centre. They were very near neighbours to London, and the supply of cheap power was an important factor for many industries. He then referred to the heavy burden thrown on the ratepayers in educational matters by the fact that they were one of London's largest dormitories, and showed that in this department, too, the Corporation was leading the country. The speech was received with musical honours.

The next toast, that of the welfare of the electricity department, was proposed by Mr. Croot. After referring to the pleasant relations which existed between the workers, staff and committee, which had so much to do with the prosperity of the undertaking, he spoke of the difficulty the engineer was placed in by the insistence of the Council that no lock-out clause should be inserted in a pending contract for new generating plant. Mr. Croot pointed out his own personal view as to the difference between a lock-out and a strike, but showed how in the negotiations which had been carried on he had placed the interests of the undertaking above his own views, and endeavoured to get the lock-out clause accepted. Mr. Couzens, in reply, recognised that Mr. Croot had loyally done his best to get the generating plant contract settled, and then proceeded to mention the continued progress made by the undertaking. Ten years ago the output for all uses was under a million units; last year it was over 25,000,000, and this year, despite the loss of some large users, it would be higher still. They used every endeavour to attract new factories to the locality, and he was glad to say that several very large users were carefully considering the question of establishing works in their area. In this way the department was an indirect benefit to the borough as a whole.

Mr. Couzens then referred to the loss the undertaking had sustained during the year by the removal of Mr. Mackenzie, the mechanical superintendent at the generating station, who had accepted a position at Bow with the Charing Cross Co., and welcomed Mr. Allan, his successor. He thanked all members of the staff for their loyalty and interest, and urged them always to place the welfare of the undertaking above their own private interests. The speech was received with many expressions of goodwill, which evidenced the good feeling existing in the undertaking. A good musical programme enhanced the success of the gathering.

East London College Engineers.—This annual function took place on Saturday last at the Great Eastern Hotel, and proved a most enjoyable function. Dr. J. T. Hewitt, F.R.S. (President of the Engineering Society), was in the chair, and was supported by Principal Hatton and other members of the staff. In proposing the toast of the evening, the Principal remarked that the Imperial College had gained the largest number of first-class honours degrees (internal) in engineering in the London University since the first examination in 1903, and the East London College came second on the list containing all the other Colleges in London.

**Inquiries.** — A correspondent wants names of actual makers of caps for small incandescent lamps. Another correspondent asks for the names of English and foreign makers of coil-winding machines, for winding cotton-covered copper wire on spool, bobbin, or directly on core, to be used for transformers, dynamos, generators, &c.; and to be complete with indicator.

**Electricity in Mines.**—The *Times* reports that Mr. McKenna has considered the objections received by him to the proposals made last May of special rules relating to the installation and use of electricity in mines. "He is advised by the Departmental Committee which framed the rules that certain modifications to meet the objections may properly be made, and he understands that these modifications, which are embodied in an amended print, are accepted by all the owners' associations throughout the kingdom from whose members objections were received. The rules will, therefore, be re-proposed in the new shape in pursuance of Sec. 54, Sub-sec. (2), of the Coal Mines Regulation Act, 1887. They will become established at the mine of any coal-owner who does not object to them within 20 days after their receipt by him."

**Firemen's Congress in St. Petersburg.** — On May 25th-28th next there will be an International Congress of Firemen at St. Petersburg, together with an exhibition of fire prevention and salvage service apparatus. Particulars can be obtained from the Committee of Organisation, St. Petersburg, Mokhowaja 5.

**The Dundee B.A. Meeting.**—This year's meeting of the British Association takes place at Dundee from September 4th to 11th, with Prof. W. E. Schäfer, F.R.S., as president. Section A will have as its chairman Prof. H. L. Callendar, while Prof. A. Barr will preside over the proceedings in Section G (Engineering).

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

**Central Station Officials.**—The St. Anne's Council has decided to grant an increase in salary to Mr. J. H. Clothier, electrical engineer, by £25 per annum, making £325.

The Bradford Electricity Committee at a special meeting held on Thursday last week interviewed three candidates for the post of commercial assistant in the electricity department, and, as a result, Mr. John E. Schofield, sales engineer to the Yorkshire Electric Power Co., has been appointed to the position. Mr. Schofield has been engaged with that company for the past three years, during which time he has been responsible for inducing a large number of power-users, such as owners of textile mills, engineering works, and collieries, in the company's area, to adopt electric driving. He had previously held appointments under the Huddersfield Corporation and the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board, and was also for some time principal engineer to Messrs. Gibbings & Chauntler, consulting engineers. In his new position he will have charge of the business development branch of the department's operations, while Mr. J. H. Schnauber (late assistant engineer in the department) has been promoted to the position of deputy city electrical engineer, vacated by Mr. H. S. Ellis on his leaving to take up the position of borough electrical engineer at South Shields.

Our Durban correspondent states that on January 27th Mr. J. H. Gyles, electrical superintendent at the Durban Corporation power station, was the recipient on the eve of his marriage to Miss Cobbledick, also of Durban, of a canteen of cutlery and a cake basket from his colleagues in the electrical department with whom he has been associated for the past 10 years. The presentation was made by Mr. John Roberts, borough electrical engineer.

The Willesden Electricity Committee reports having received the resignation of Mr. J. G. Bruce, the electrical engineer. It has also received the resignation of Mr. L. F. Bickell, chief distributing engineer, and to fill this position, Mr. F. D. Balshaw has been appointed at a salary of £120, with apartments at the substation.

The Liverpool Corporation has appointed Mr. John Hamilton, of the Glasgow Corporation electricity department, as an assistant engineer in the electric supply department.

**Tramway Officials.**—The Light Railways Committee of the Southend-on-Sea T.C. has increased the salary of Mr. A. C. Johnson from £200 to £220 per annum, with subsequent annual increments of £20 to £300 at the discretion of the Committee.

Mr. W. Wilson, who has been in the employ of the Camps Bay Tramways Co., has been appointed chief traffic superintendent to to the Port Elizabeth Tramways, and prior to leaving he was presented by Mr. Farquhar, secretary to the company, with a gold watch.

When the recommendation of the Tramway Committee of the West Ham T.C. to increase the salary of Mr. F. Eggington, chief assistant, from £250 per annum to £275, rising to £300 a year hence, was considered, the voting was equal, 20 members voting for the increase and 20 against. Thus the matter for the present remains in abeyance.

**General.**—A Cape correspondent writes: Mr. John Denham, M.I.E.E., who acted as Government electrician to the late Government of the Cape Colony for many years, is being transferred to the Mines Department at Johannesburg under the new Union Government. Mr. Denham also acted as local representative of the Institution of Electrical Engineers. Owing to so many changes and transferences in the Government Post Office and Railway Electrical Departments, the local section of the Institution of Electrical Engineers has been completely disorganised, and it is feared that it will become disbanded.

Mr. C. H. Wordingham, M.I.C.E., superintending electrical engineer to the Admiralty, has been elected a Fellow of King's College, London.

*Indian Engineering* states that Mr. A. N. Dixey, assistant telegraph superintendent, Great Indian Peninsular Railway, is the superintendent of the G.I.P.R. new electrical department, under the locomotive superintendent, Parel, Bombay, and Mr. J. P. Rees is the electrician.

The Southport Corporation Tramways and Electricity Employés' Social and Athletic Society has presented a gold watch and chain to Mr. John Griffiths in recognition of his services as secretary.

The Ossett T.C. has appointed Mr. Mottram, gas manager, as electrical adviser to the Corporation for a year.

According to the *Times* the King has sent a scarf-pin to Mr. L. J. Steel, electrical engineer, of Portsmouth Dockyard, in recognition of his services in connection with the preparation of the *Medina* for their Majesties' voyage to India.

**Obituary.**— Mr. G. E. Pritchett.—We regret to record the death of Mr. George Edward Pritchett, F.R.I.B.A., which occurred at his residence at Bishops Stortford, on Saturday last, after a short illness. The deceased gentleman, who had reached the advanced age of 88 years, had made many friends in the electrical world, in which, though an architect by profession, he played an interesting part in the early pioneering days of electric lighting in London. Between 20 and 30 years ago, with one of his sons, Mr. G. E. B. Pritchett (now one of the managing directors of Pritchetts & Gold), he started, as G. E. Pritchett & Co., an electric light station at Black Horse Yard, Rathbone Place. This was equipped with Brush series arc machines giving supply, on the series arc lamp system, to a large number of shops and business premises in Oxford and Regent Streets and neighbourhood, by means of overhead wires. The station was also equipped with the first two Mordey alternators ever made, supplying A.C. at 2,000 volts. The undertaking was the second electrical distribution scheme carried out in London, the Grosvenor Gallery installation having preceded it by a couple of years. The Black Horse Yard station was sold to the Metropolitan Electric Supply Co. a few years later, when the Electric Lighting Act of 1888 was introduced, and it was run by that company for some time. It now forms a distributing station in connection with the Marylebone municipal electric supply system. Some 14 or 15 years ago the deceased gentleman retired from his architectural profession, and since then he has been taking a special interest in electrical matters, particularly in X-ray work. He was an original member of the Röntgen Society, an Associate Member of the I.E.E., and a Fellow of the Society of Antiquaries. This journal has lost in Mr. Pritchetts one of its oldest and most constant readers, for he had been a subscriber to the Electrical Review from the beginning (40 years ago this year) up to the time of his death, and a complete set of our volumes from No. 1 to No. 69 are in his library at Bishop's Stortford.

Col. G. E. Gouraud.—The *Times* contains a notice of the death, which occurred on February 17th, at Vevey, Switzerland, of George Edward Gouraud, C.M.H., Colonel, late of the U.S. Army, at the age of 70 years. The name of Col. Gouraud will be familiar to many of our readers as that of Edison's representative on this side of the Atlantic some years ago.

Dr. Osborne Reynolds, F.R.S.—We regret to record the death of Dr. Osborne Reynolds, Emeritus Professor of Engineering at Manchester University, which occurred at Watchett, Somerset, where he had resided since he retired from the acting professorship six years ago. Dr. Reynolds was born in 1842. Among other important work carried out by him was the organisation and arrangement of the Whitworth Laboratories at Owens College.

Mr. J. Holdron.—The death occurred on February 23rd, of Mr. John Holdron, who had for many years been in business as an electrical engineer in Market Place, Ashby-de-la-Zouch. He was 65 years of age.

# THE SYDVARANGER IRON MINES IN NORWAY.

The most northern province of Norway is Finmarken, which extends from Tromsö to the Russian frontier to the north of Finland, and covers an area corresponding to about one-seventh of that of the whole country (124,495 sq. m.). Finmarken is very thinly peopled, and its population

Fig. 1.—Concentrating Plant and Power Station Buildings, Kirkenas.

represents only one-seventieth of the whole population, which is only natural on account of its northern latitude, the latter reaching to 71° 11′ N.

The Sydvaranger Iron Mines are situated at the bottom of the Varanger fiord, which is the most easterly of the immense number of fiords in Finmarken, and if the map be consulted it will be found that the exact latitude of the mines is 69° 40′ N. They were discovered in 1902 by a party who were prospecting for copper, but struck iron instead. A Norwegian merchant, Mr. Anker, was the leading spirit, and he at once started trial works with the view of ascertaining the extent of the deposits, with the result that the Aktieselskabet Sydvaranger was formed in 1904 with a capital of £666,667.

The magnitude of the capital is sufficient to show that the deposits in question were not going to be dealt with in a small way, and, in fact, according to the original estimate, the annual output was calculated at 600,000 tons of concentrates and briquettes. Owing to various unforeseen difficulties these anticipations have not been fully realised, for which reason the company have been obliged to secure additional capital in order to carry out the original plans to their full extent.

The results of the company's activity up to the present are, however, the completion of a concentrating and briquetting plant with a capacity of about 300,000 tons per year, which started operations in the autumn of 1910, and as a further and not less satisfactory result, it may be mentioned that a small town with a population of 2,000 has grown up at the shipping port, Kirkenäs, with a truly American speed.

In spite of the high latitude the climatic conditions are by no means intolerable, although the average temperature during seven months of the year is below zero, and may occasionally drop as low as 30°-40° F. below zero. In July and August it is more than 50° F., and rises occasionally even to 70°-80° F. The most extraordinary feature is, however, this: that Kirkenäs is practically an ice-free port, while Christiania, for instance, which is situated about 9 degrees further to the south, is only kept open by means of ice-breakers.

The deposits cover an area of about 3,500 acres, and the ore occurs in lodes, which are up to 600 ft. wide, the length varying from 1 mile downwards.

The geological formation of the territory is of volcanic origin, and the iron ore occurs in granite gneiss. The total quantity of ore has been estimated to amount to 1,000 million tons to a depth of 100 metres, of which 400 millions are accounted for in the Björnevands Mines, which are the most important of the various deposits, and are situated at the centre of the territory, about 5 miles from Kirkenäs. These are the first to be exploited, and there are about 50 million tons which can be extracted by quarrying. The ore is chiefly a low-grade ore, holding from 34 to 37 per cent. of iron, although there are also some 4 million tons of ore at the lake of Oernevand of a content of 52-53 per cent. of iron.

These mines are connected with the port of Kirkenäs by means of a railway, which is almost the only part of the whole plant not worked by means of electricity.

The locomotives employed are of the so-called fireless type, which are operated by means of steam of 200 lb. pressure, the charging being effected from a stationary boiler plant. The ore on the surface at Björnevand represents a whole mountain, which has been laid out in five benches at a height of about 65 ft. The drills used are the Ingersoll rock drills, which are worked by means of electricity, and are capable of boring vertical holes to a depth of 11 yards.

One may get an idea of the scale on which the work is carried out, when it is mentioned that 65,000 tons of ore, or a trifle more than the gross tonnage of both the *Lusitania* and the *Mauretania*, have been blasted in a single operation.

For loading the broken ore on the railway trucks, Marion steam shovels of a capacity of 90 tons an hour are used.

From the quarry the ore is carried on flat cars with loose 10-ton buckets to the preliminary crushing plant in the vicinity, where the ore is crushed by means of an Allis-Chalmers gyratory crusher to a size of 10 in. or less. This crusher is driven by a motor of 250 H.P., for which the energy is supplied from the central power station at Kirkenäs. The consumption of power at full load varies from 160 to

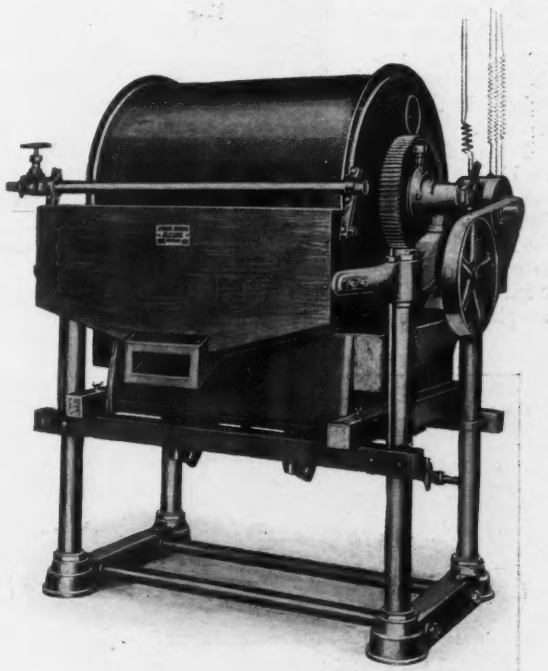


Fig. 2.—Gröndahl Magnetic Separator.

170 H.P. After having been crushed, the ore is conveyed by means of a 36-in. belt through a tunnel to a number of bins on the side of the hill, which are capable of holding 4,000 tons of ore.

These bins are built on the solid rock, and from them six railway trucks of a capacity of 45 tons each can be filled

at a time, by means of which the ore is carried to the plant for concentration and briquetting at Kirkenäs.

The buildings of this plant are very large, and cover at the present time an area of 17,000 sq. m.; when they are completed this will be increased by 5,000 sq. m., making in all 22,000 m.²

A view of the buildings is shown in fig. 1, and as will be seen, they have been built on an incline so as to allow of the ore being subjected to the various processes in succession by gravitation. The whole plant has been built according to the Gröndahl wet system, and it has been divided into 20 separate working units, of which 12 are in operation at present. According to the estimate the capacity of each unit is 300 tons per 24 hours, and the whole plant, when completed, will thus be able to treat 3,600 tons per diem.

Each of the aforesaid units consists of an ore bin at the top, from which the ore passes to a Hadfield jaw crusher. By means of a conveying belt, it is carried to a distributing bin, and further through two ball mills, fed automatically, and through two sets of Gröndahl separators, two tube mills, and finally through two sets of finishing tandem separators, after which the concentrates are collected in settling tanks.

The various parts of the plant are arranged in a series of terraces, one for each class of machinery, and the whole treatment of the ore being carried out on the gravitation principle, it follows that the ore passes quite mechanically from one part of the machinery to the other, assisted by the flow of water.

Passing from the ore bins at the top, the crude ore is reduced by means of the Hadfield crusher to a size of about 2 in., after which it is carried to the distributing bins, which are placed above the ball mills (fig. 3).

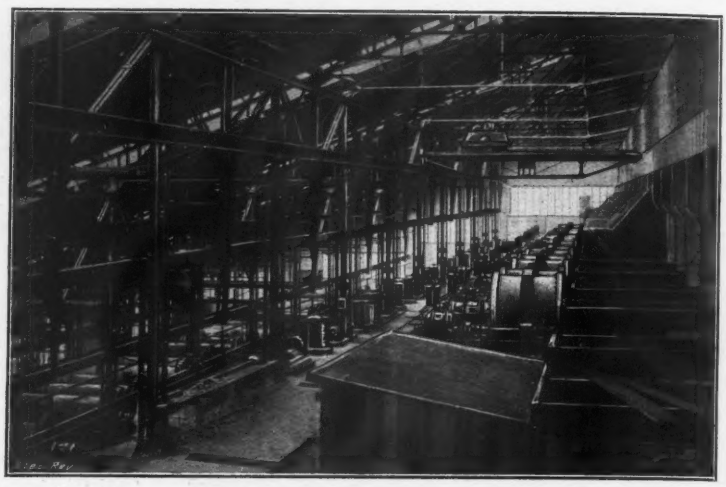


Fig. 3.—Distributing Bins and Ball Mills.

Fig. 4.—Gröndahl Magnetic Separators.

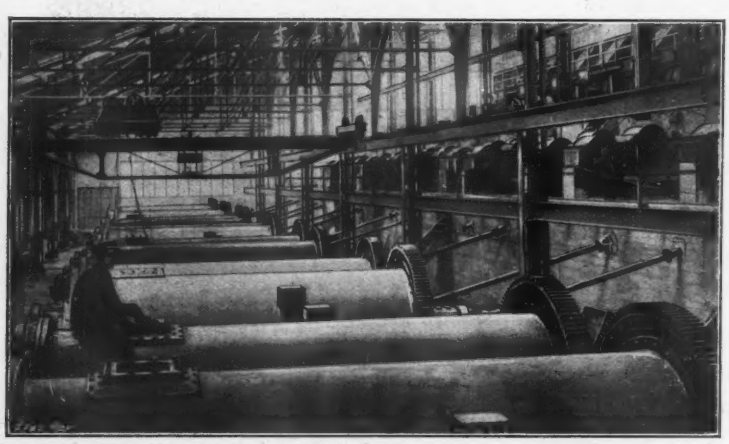


Fig. 5.—Tube Mills.

The latter are of the Gröndahl type, and are supplied with automatic feeders. They are made from cast-iron cylinders lined with chilled cast-iron bars, which form a corrugated surface. The mills are charged with 4 tons of steel or cast-iron balls, by means of which the ore, with the assistance of water, is ground to a size of about 20 mesh, and they are each driven by a separate electric motor. The mills have a working capacity of 150 to 200 tons of ore per 24 hours, and the power required varies between 50 and 100 H.P.

Having passed the ball mills, the concentrates, which now represent a mass resembling pulp, proceed to the Gröndahl patent magnetic separators, of which fig. 2 gives an illustration, while the whole set of separators is shown in fig. 4. The separators are arranged in tandem, and the brass drums are 34 in. long, their diameter being 28 in. The drums rotate around a fixed system of electromagnets of alternating polarity, the lowest point of the same being about $\frac{1}{2}$ in. above the water level in the weir box.

In order to get rid of the bulk of the non-magnetic slimes, the ore may be passed through a slime box before being charged into the separator.

The pulp passes under the rotating drum, which encloses a magnet with specially-designed pole-pieces, and it is thus not fed directly on the drum, but is brought under the magnetic influence by the flow of water from the ball mills into the weir box. During its passage the pure magnetite of the ore is drawn by the magnets out from the water, adheres to the drum and is carried round to the limit of the magnetic field, where it is swept off by a spray of water, the tailings being carried off to the dumps.

Having passed the first of the tandem separators, it is quite possible that the concentrates may have carried with them some of the non-magnetic particles, and for this reason the process is repeated in the second separator, so as to get

rid of all unnecessary matters, and thus increase the iron content. Both separators are capable of dealing with more than 150 tons of concentrates per 24 hours.

They are belt-driven by a motor, and the power which is required for magnetising purposes amounts to 8 amperes at 220 volts for each separator.

From the separators the pulp passes to the tube mills (fig. 5), which are not an essential part of the machinery for this process, but are necessary for the Sydvaranger ore on account of its fine granulation, which necessitates a regrinding of the ore. After having passed the first set of separators, the concentrates hold up to 55 per cent. of iron. But having been ground in the tube mills and treated by a finishing set of separators exactly like those described above, the content of the final products is brought up to 69 per cent. of iron. The concentrates are finally carried to settling tanks, the number of which is six. Each of these is capable of holding 3,000 tons. When the water has been drained off, the tanks are emptied by means of grab buckets, and the concentrates are either passed to the briquetting works and pressed into briquettes of a size of $6 \times 6 \times 2\frac{1}{2}$ in., or they are subjected to a drying process and shipped as fine ore or "slig," which this particular brand of ore has been called.

The only available waterfalls in the neighbourhood of the mines were those of the Pasvik River, which forms the boundary line between Norway and Russia. But owing to various difficulties with the Russian Government, the company had to abandon the idea of employing water-power, and had to resort to steam instead. The central power plant is erected at Kirkenäs, and the whole plant, when completed, will consist of the following parts:—Three steam turbo-generators designed for three-phase alternating current at a pressure of 800-850 volts, the maximum output of each being 3,750 H.P.; one steam turbo-generator for three-phase alternating current, 800-850 volts, of 300 H.P.; one steam turbo-generator for continuous current, 220 volts, 275 H.P.; and four centrifugal pumps, directly-driven by motors with three-phase alternating current, each pump possessing a capacity of 1,660 gallons per minute with 230 ft. head. The boiler plant will consist of seven Babcock & Wilcox boilers with superheaters, mechanical stokers and three 240-tube economisers. Five of the boilers have been installed, and two of the above-mentioned large generators, for the working of which two boilers are designed for each generator, while one boiler is kept in reserve. The whole plant has been delivered by the De Laval Steam Turbine Co., of Stockholm. Each boiler has a heating surface of 5,375 sq. ft., and the pressure is 180 lb. per sq. in.

The turbines are directly connected by means of spring couplings with the 2,100-KW. generators, which are provided with direct-coupled exciters, and run at a speed of 1,500 R.P.M. The results of the tests of the electric plant were as follows:—

| | | |
|---|---|---|
| Output of generator, KW. ... ... | 2,135 | 2,140 |
| Steam per KW.-hour, lb. ... ... | 16 | 16·61 |
| Auxiliary machines, KW. .. ... | 56 | 52 |
| Net KW. ... ... ... ... | 2,079 | 2,088 |
| Lb. coal per net KW.-hour ... ... | 1·95 | 1·91 |

FIG. 6.—ELECTRICALLY-DRIVEN WHARF CRANES.

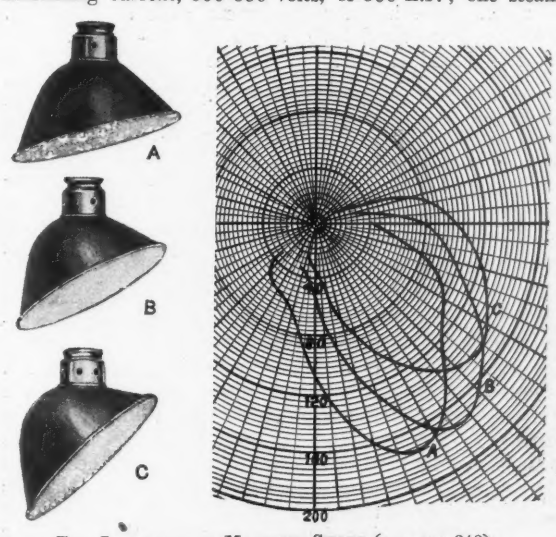
The necessary coal for the plant is carried by means of an aerial ropeway either from the ships directly or from the stores at the quays, and delivered to a stock-pile in front of the power plant. From the central station the energy is transmitted to the concentrating plant, to the mines, and to all other places where it may be required, as, for instance, for lighting purposes at Kirkenäs, &c.

The tracks to the quay are laid at a height of nearly 50 ft. above the level of the quay, and here are placed two electrically-driven cranes with a lifting capacity of 12 tons each (fig. 6). The bridge has been built at such a height so as to enable 12,000-ton steamers to be loaded. It requires a time of about five minutes for each crane to lift a loaded bucket, to carry it forward above the ship, to lower and to empty it into the hold and place it back on the car.

Being worked day and night, both cranes can manage to load a quantity of from 4,000 to 4,800 tons of ore daily.

For the discharging of coal there is a separate quay, 165 ft. long, equipped with rails and a crane, also electrically driven, capable of dealing with 800 tons per 24 hours. The aërial ways, by means of which the coal is distributed to the various places, are capable of carrying 40 tons each per hour.

In conclusion, it may be stated that no mines have ever been started with such a complete equipment from the very beginning as the Sydvaranger Mines, and the extensive use which has been made of electric power for nearly all purposes shows that electricity has gained such a firm footing in the mining industry that it has become altogether indispensable. Even for lighting purposes it holds its own at Sydvaranger, and that in the face of two such formidable competitors as the midnight sun in summer and the aurora borealis in the winter.




THE LIGHTING OF MACHINE SHOPS (see page 348).
FIG. 1.—EFFECT OF SHADES AT DIFFERENT ANGLES.

**Electric Smelting in Sweden.**—The Stora Kopparbergs Bergslags Co., of Falun, which, a few years ago, introduced a 700-H.P. electric furnace of the Elektrometall type, is now reported to have acquired a licence for the use of the type of furnace devised by Dr. Helfenstein, of Vienna. It is proposed to erect furnaces of 12,000 H.P. for the extraction of iron from ore, the plant to be brought into operation in the autumn.

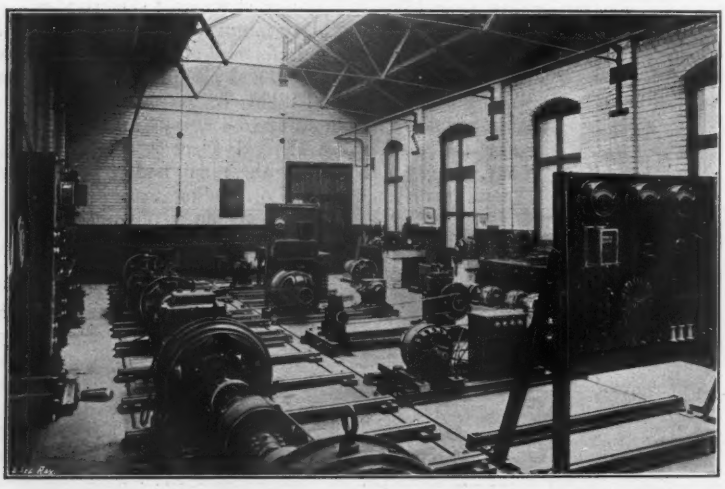
## THE LIGHTING OF MACHINE SHOPS.

Attention has been frequently directed to the important influence which adequate lighting has upon the efficiency when large machine-shop operations are carried out, and this has been, and is, one of the arguments in favour of the adoption of an electric system of power driving in the shop.

Fig. 2.—Bad Lighting.

Fig. 3.—Correct Lighting.

Quite apart from the advantages which electric motive power offers in connection with the convenient arrangement of the tools and scientific splitting-up of the power demand into appropriate groups, it has become recognised that efficiency has been very largely increased by the clearing away of overhead shafting and belting, which formed obstructions to the good and uniform lighting of machine shops, both during daylight hours and during hours of artificial lighting. It should be pointed out, by the way, that such clearing away of overhead obstructions materially increases the hours during which natural daylight could be used.



Manchester University: John Hopkinson Dynamo Room (see page 349).

When artificial lighting becomes necessary, the question of the best arrangement of lighting units becomes a very important one, and it is nowadays usual to pay attention in a greater or less degree to the question of good illumination. In considering this problem, it is the custom within economical limits to divide the lighting units into a considerable number of points, spaced at greater or less distances apart, according to the light intensity which is required at the point of minimum illumination, and the variation between the maximum and minimum limits which is permissible. In this connection the candle-power of the lamp itself is not the only consideration. Due account has to be taken of the way in which the light has to be distributed, and the area over which the light is incident. Speaking in general terms, it may be said that the foot-candle intensity for an ordinary machine shop should be about unity, this, however, being increased if the operations require minute attention, or where special conditions exist. For example, in the drawing office a light intensity of eight is not too much, the pattern shop should have an intensity of about three, and for fine work, such as engraving, the intensity should be about 10 ft.-candles. For general illumination in a factory where additional special illumination for each machine or bench is provided, the intensity may be one-and-a-half, while the local bench illumination should be about four. If no local illumination is provided, it should be the aim of the electrical engineer to provide a uniform illumination of the order of 4 ft.-candles intensity.

The subject, however, does not end with the question of general or local intensity of illumination, but the question of direction has also to be considered. Light may be provided of the proper intensity, and spread in a satisfactory manner, but owing to the exigencies of the work which is being done and the position of the operator, it may be found that the actual effect upon the operating efficiency is not so good as was anticipated. For this reason the question of shading becomes of very great importance. Perhaps a concrete instance will do more to explain this point than a good deal of theoretical argument, and this is supplied in the illustrations annexed. Fig. 1, p. 347, shows a photometric sheet of some steel reflectors made by the Holophane Co., of Newark, Ohio, U.S.A., the curve A representing the distribution of light given by the top shade figured ; B that of the middle shade ; and C of the lowest one, as tested with a 60-watt, 110-volt clear metal-filament lamp taking 1·18 watts per C.P. It will be seen that even with the slight divergences of the axis of the shade from the vertical, a totally different

distribution curve is given in each of the three cases, and this opens up considerable possibilities in the directing of light in connection with machine-shop operations. The importance of this point will be understood when it is realised that the influence of reflector equipment and the need of carefully selected suitable types of reflectors for industrial requirements such as mills, factories, foundries, machine-shops, &c., is fully as vital as in every other class of lighting service, and perhaps more so. The need for the proper shading of the lighting sources is often as important as the attainment of correct foot-candle intensity on the work, and figs. 2 and 3 illustrate very forcibly the glare effect from bare lamps and the improved illumination from good reflectors. In the former case, the lamp, although correctly placed, threw the light directly into the eyes of the operator and made his work on the slotting machine extremely difficult and fatiguing. The application of the shade, however, had the effect both of shading the operator's eyes and of throwing the light with increased intensity upon the work. The reflector used was an angular-type Holophane d'Olier steel reflector, like those shown in fig. 1, but of suitable size to suit the standard carbon lamp.

In many respects factory and machine-shop lighting has not yet reached finality in this country, and it would almost seem as if factory designers had not realised that a careful study of illumination problems was a directly useful piece of work, and not simply a fad. When this fact eventually is appreciated—a process which, unfortunately, may take some time—many of the anachronisms which at present exist in our industrial establishments will be done away with. At the present time electric lighting has been widely adopted for factory uses, and is highly appreciated; but it is not too much to say that its advantages are, in many cases, being thrown away owing to the lack of knowledge or interest of those responsible for the equipment.

## NEW ELECTRICAL LABORATORIES OF MANCHESTER UNIVERSITY.

To-day the new Physical and Electrotechnical Laboratories of the University will be opened by Prof. Arthur Schuster, who held the chair of Physics from 1888 to 1907, and designed the original equipment of the Physical Institute. On his retirement Prof. Rutherford was appointed to the chair of Physics, and Dr. Beattie, who had been in charge of the Electrical Engineering Department, continues in that position. The extensions have been necessitated by the steady increase in the numbers of research students and by the use of large quantities of radio-active substances, the radiation from which disturbs electrical measurements in adjoining rooms, and the Council decided to provide new premises entirely for the Department of Electrical Engineering.

The new Electrical Engineering Laboratories are not actually larger than those formerly occupied, but are more conveniently subdivided and arranged; a separate workshop, battery room, lecture room, and research rooms have also been provided, and the department as a whole has been considerably enlarged. The laboratories are also advantageously situated for easy intercourse with a number of related departments. The new building includes on the first floor a number of small rooms for physical research, and a glass-blower's workshop, the latter, with the tinsmith's workshop below, serving the needs of the University in general. The electrotechnical laboratories occupy the ground floor, where they are conveniently grouped round the dynamo room. They comprise direct-current and alternating-current rooms, drawing room, workshop, research room, switchboard room, magnetic testing laboratory, battery room, private research room, &c., with a lecture room on the first floor specially equipped for the teaching of electrotechnics. Bare wires on insulators have been adopted for the experimental circuits. A 600-A.H. battery has been installed, in addition to the smaller battery already available in the main physics department.

The equipment of the dynamo house and the laboratories, both old and new, has been carried out by Dr. R. Beattie, the head of the department. The number of students in attendance at the lectures has averaged over 50 in recent years, and the increase in their numbers has necessitated the creation of a demonstratorship, to which Mr. H. Gerrard has been appointed. Much valuable research work has been carried out by Dr. Beattie, in connection with applied magnetism and A.C. measurements.

We give on the opposite page a view of the interior of the John Hopkinson dynamo house, which forms the nucleus round which the new laboratories have been built.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The British Columbia Electric Railway Co. intends to make some very large extensions to its plant this year. One of the existing generating stations has a plant of about 50,000 H.P., and it is proposed to increase this to 85,500 H.P. The company has also an auxiliary steam plant, the capacity of which it intends to increase from 12,000 H.P. to 20,000 H.P. Messrs. Dick, Kerr & Co., Ltd., it is understood, are to make three generators which will be driven by three water turbines of 14,000 H.P. each. By the end of 1912 the company's available power will thus be 105,000 H.P.; about £200,000 will be spent on these extensions. Proposed future work indicates that the total power will approach 200,000 H.P.

The Western Canada Power Co., whose generating station is at Stone Falls, B.C., have put into operation one of the largest units so far installed in Canada, with the exception of those at Niagara Falls. Two units are to be erected of 13,000 H.P. each; the head of water for the turbines is 110 ft.

The question of enlarging the Welland Canal which runs from Lake Erie to Lake Ontario, practically parallel to the Niagara River, is under consideration by the Dominion Government. The idea is to make it possible for ocean-going vessels to pass through the canal.

If the scheme goes through, the canal will almost certainly be in such a manner as to provide the maximum amount of water power consistent with satisfying the requirements of navigation.

It is more than probable that the next few years will see a great opening up of the immense territory known as New, or Northern, Ontario. Great mineral wealth, fertile soil, timber lands and water powers of some magnitude, are among the attractions of this region.

In the past, the Dominion Government has only tried to people the West, with the result that the older Provinces, such as Ontario and Nova Scotia, have been left out in the cold. Now, however, Federal assistance will be given in the matter of immigration, and in other ways, to every Province, and, as an outcome of this encouragement, the Government of Ontario proposes to spend £1,000,000 on the development of the northern parts of the Province which have hitherto been practically unheard of. This money will be expended on the making of good roads, development of water powers, and other public works.

**Letters Stolen.**—Messrs. Bi-Metals, Ltd., the proprietors of Tinol, and Messrs. Neville Williams & Co., of 80A, Southwark Street, S.E., inform us that their premises were broken into on the evening of February 22nd, and all the letters were stolen from the letter box. They will be extremely obliged if anyone writing to them on or about that date, and not having received an answer, will kindly furnish a copy of his letter.

**Petrol-Electric 'Buses.**—Messrs. W. A. Stevens, Ltd., inform us that they secured orders for 20 Tilling-Stevens petrol-electric 'buses for the Birmingham and Midland Motor-Omnibus Co., Ltd., and for six similar vehicles for the Greenock and Port Glasgow Tramways Co.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Evershed & Vignoles, Ltd.** (43,206).—A memorandum of satisfaction to the extent of £14,000 (being amount issued) on February 1st, 1912, of trust deeds, dated February 11th, 1902, and January 18th, 1904, securing £15,000, has been filed. Issue on February 3rd, 1912, of £300 debentures, part of a series of which particulars have already been filed.

**Holsworthy Gas and Electric Supply Co., Ltd.**—Debenture, and as collateral security thereto, a mortgage, both dated January 27th, 1912, to secure £500, charged on the company's undertaking and property, present and future, including any uncalled capital and certain land and premises in Holsworthy, Devon. Holder: W. Harris, Ratherton, Holsworthy.

**Concordia Electric Wire Co., Ltd.** (74,416).—Return dated November 9th, filed November 14th, 1911. Capital £2,000 in £1 shares. All shares taken up. £1 per share called up on 7 and 10s. per share on 1,993. £1,003 10s. paid. Mortgages and charges: Nil.

**Cape Electric Tramways, Ltd.** (54,636).—Return dated November 15th, filed November 23rd, 1911. Capital £500,000 in £1 shares. 491,222 shares taken up. £491,222 paid. £400,000 considered as paid. Mortgages and charges: £484,500.

**Morris & Lister, Ltd.** (202,268).—Particulars of £1,500 debentures, created February 7th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £600. Property charged: The company's undertaking and property, present and future, including uncalled capital, subject to first and second debentures. No trustees.

**Buenos Ayres Port and City Tramways, Ltd.** (85,427).—Trust deed dated January 26th, 1912 (supplemental to trust deed dated June 10th, 1910), to secure £350,000 extension first mortgage bonds, ranking *pari passu* with an issue of £150,000 like bonds secured by principal deed. Property charges: Certain concessions and benefits thereof, £86,000 debenture bonds of the Buenos Ayres City and Suburban Tramways, Ltd. (ranking in priority to previous deeds), all lands, buildings and rights and easements over land and other property acquired out of proceeds of this issue and company's undertaking and other assets, subject to said trust deeds. Trustees: Beaver Trust, Ltd., 1, Queen Victoria Street, E.C.

**East India Tramways Co., Ltd.** (74,457).—Return dated December 13th, 1911. Capital, £80,000 in 15,000 preferred, 35,000 ordinary and 30,000 deferred shares of £1 each. 7,476 preferred, 33,433 ordinary and 30,000 deferred shares taken up. £1 per share called up on 7,476 preferred and 7 ordinary. £7,477 10s. paid, leaving £5 10s. in arrears. £63,426 considered as paid on 33,426 ordinary and 30,000 deferred. Mortgages and charges: Nil.

**Douglas Southern Electric Tramways, Ltd.** (45,701).—Return dated December 21st, 1911, filed January 8th, 1912. Capital, £50,000 in 30,000 preferred and 20,000 ordinary shares of £1 each. 25,978 preferred and 15,472 ordinary shares taken up. £1 per share called up on 12,566 preferred and 5,804 ordinary. £18,370 paid on 12,566 preferred and 5,804 ordinary. £23,075 considered as paid on 13,407 preferred and 9,668 ordinary. Mortgages and charges: Nil.

**Alliance Electrical Stores, Ltd.** (111,884).—Return dated January 13th, filed January 25th, 1912; capital, £25,000 in 47,500 preferred ordinary shares of 10s. each and 1,250 deferred ordinary shares of £1 each. All shares taken up; 10s. per share called up on 7 preferred ordinary; £3 10s. paid; £24,996 10s. considered as paid on 47,493 preferred ordinary and 1,250 deferred ordinary. Mortgages and charges: Nil.

## CITY NOTES.

### Yorkshire Electric Power Co.

Mr. A. G. Lupton presided at the half-yearly meeting held at the Hotel Metropole, Leeds, on February 20th. In moving the adoption of the report (see Electrical Review, page 226), he said that almost all the expenditure of the year had been on extensions of mains and sub-stations, and on apparatus in customers' premises to secure new revenue. Since the report and accounts had been issued the whole of the £100,000 preference shares had been applied for, and the directors would now ask for a quotation for this stock on the Leeds Stock Exchange. The revenue of the company had continued to grow, though much delayed by the breakdown in the summer. This involved special arrangements and the installation of temporary plant, which caused them much anxiety, but by these means all serious inconvenience to the customers of the company was avoided, though at considerable extra running costs. The plant was now all at work again, and in the meantime, to further secure the reliability of the supply and give a larger margin of safety, two additional units of generating plant had been ordered. During the past year an agreement had been made with the Heckmondwike U.D.C. for a bulk supply, which would be commenced in the course of a few days. The company would then be giving a bulk supply to six local authorities in its area. In addition to these six districts, energy was being supplied to the Distribution Co. for nine other districts. The directors had always looked to bulk supply forming a large part of the company's business, and although local authorities had been slower to see the advantages of such a supply than was first anticipated, it was gratifying to find that supply in bulk was rapidly becoming a considerable proportion of the company's output. The company had taken up £8,823 in ordinary shares of the Distribution Co., which was now becoming one of the largest customers on their system. The accounts of that company for 1911 showed satisfactory progress. In addition to the connection of a considerable number of new motors by existing customers, further supply agreements had been made with colliery proprietors, textile manufacturers, engineers, and others, and the company had now a large number of other inquiries for power under consideration. There had lately been considerable development in the use of electricity for street lighting purposes, and the company's energy was being used in a number of districts in the West Riding. In regard to the fear of a great coal strike, they had made all the preparations possible to maintain the supply.

Mr. H. A. Earle seconded the resolution, which was carried

### Underground Electric Railways Co. of London, Ltd.

The half-yearly meeting was held on Thursday last week at Electric Railway House, Broadway, Westminster, Sir Edgar Speyer, Bart., presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 189), said the directors were able to indicate fresh progress. Both the District Railway Co. and the London Electric Railway Co. had demonstrated their vitality and recuperative power. The continued advance in the District traffic was specially noteworthy. The opinion expressed by him at the last half-yearly meeting as to the prospects of this company had been realised, and the company had begun to pay dividends on its second preference stock, which meant a fresh source of income to their company, which owned the entire stock, and the outlook for further expansion was favourable. They would also notice that the London United Tramways were emerging from their depression. The physical condition of the line had been greatly improved, and they hoped that the conservative policy of the board in building up a reserve would further strengthen that undertaking. They expected that the award in the arbitration between the company and the London County Council regarding the Hammersmith and Shepherd's Bush lines would be given almost immediately, which, if it did nothing else, would remove an element of uncertainty from the company and would create a clear situation. The revenue account showed total receipts of £156,548, an increase of £10,528, or about 7¼ per cent. on the second half of 1910, and the net revenue before allowing for income bond interest was £54,015, a gain of £27,586, or over 104 per cent. After referring to the income derived from investments, the chairman said that when they received the next balance sheet they would find that the suspense items on the asset side, which now amounted to about £1,000,000, would have been reduced to a little over £350,000 by means of the surplus realised in excess of the book value of the power house. With regard to the pending Westinghouse case, he had only to say that the Court of Appeal had decided in their favour. They had recently learnt that the Westinghouse Co., not content with this second decision, was carrying the matter to the last tribunal, and was appealing to the House of Lords. The most important event, however, in the fortunes of the company had been the acquisition of the London General Omnibus Co. which, subject to several confirmatory meetings, had been successfully accomplished. With regard to the future the past year had been a prosperous one for the whole country in general and for London in particular. No better index could be obtained of the course of trade and of general prosperity than the trend of railway earnings. The expansion in the earnings of the railways of this country in the past year had been a large one—nearly 3 per cent., but nowhere had the expansion been so large as in London. In the past year the gross receipts of the District Railway had shown the substantial expansion of 7 per cent., and the gross receipts of the London Electric Railways the large increase of nearly 6 per cent. He was glad to say that the outlook of 1912 was for an additional expansion in trade and in the earnings of railways, especially in those of the railways of London. It was true that at the moment the favourable outlook was completely overshadowed by the danger of trouble in the coal trade, but he trusted that some way would be found to adjust the matters in dispute, and that a spirit of reasonableness would be displayed by employers as well as by the employed. There could be no doubt that if the dispute was permitted to develop into war the blow to the prosperity of this country would be disastrous. Then, again, the international political situation had recently shown a great change for the better. With a general feeling of greater confidence throughout the world, with cheap money, active trade, large profits, and with good wages in this country, there seemed little doubt that London would enjoy an exceedingly prosperous year. Indeed, should no untoward event arise, there were grounds for expecting that 1912 would be the most prosperous year that London had ever experienced, and the Tubes, the District and the 'bus company would enjoy a greatly increased volume of business.

Sir Algernon West, G.C.B., seconded the motion, which was adopted without discussion.

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At an extraordinary general meeting held on Tuesday, Sir Edgar Speyer presiding, the resolutions embodying the acceptance of the scheme for the acquisition of the ordinary stock of the L.G.O., and for the increase of the capital of the Underground Electric Co., by the creation of 1s. "A" shares, were unanimously confirmed as special resolutions.

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**Aberdeen Suburban Tramways Co.**—The directors report that the profit earned for the half-year ended January 31st amounts to £1,420, making, with the sum carried forward, a balance of £2,130 at the credit of profit and loss account. The directors recommend that the sum at the credit of profit and loss account should be carried forward.

## Paisley District Tramways Co.

Mr. Owen Hugh Smith, chairman, presided on February 22nd at 83, Cannon Street, E.C., over the meeting of this company.

In moving the adoption of the report (see Electrical Review, page 271), the Chairman said the traffic receipts showed an increase for the past half-year of £3,963 and a total increase of £7,032 for the full year, this being mainly due to the extension from Barrhead to Rouken Glen, which had amply justified its construction. The tea gardens at the company's terminus at Rouken Glen proved a great attraction during the year, and the concerts and other amusements provided were much appreciated. The expenses showed an increase of only £1,608 during the past half-year and £2,181 for the full year. A considerable saving in expenses was attributable to the reduced price they were paying for energy supplied by the Paisley Corporation now as compared with last year. The board had added £4,500 for the past year to reserve for depreciation, and interest had also been credited to the reserve, making £30,553 at credit as at December 31st; £10,000 had been invested in trustee securities, and the balance was in their own undertaking. After providing for debenture interest and setting aside £750 for the debenture sinking fund, the balance allowed for payment of £1,000 to the preference share sinking fund, a dividend for the half-year at the rate of 5 per cent. per annum on the cumulative preference shares, and 3 per cent. on the ordinary shares, and £2,559 was carried forward. As seen from the balance-sheet, £700 debentures had already been redeemed by the trustees.

Mr. D. Johnstone Smith seconded the motion, and it was carried without discussion.

On the motion of Mr. O. H. Smith, Lord Arthur Butler was re-elected a director.

## British L. M. Ericsson Manufacturing Co., Ltd.

The ninth annual meeting of this company was held on February 22nd at Byron House, Fleet Street, E.C., Mr. W. M. Crowe presiding.

The Chairman first referred to the death two weeks ago of Mr. George H. Robertson, chairman of this company since its inception in 1903. The speaker then alluded to the changes which had taken place in the constitution of the company. In December last it was found necessary to form the concern into a public company, so that they could make an issue of shares to the public. The reason for issuing those shares was that the business of the company was growing enormously, and, consequently, more capital was required. A further reason was that they had to pay off the £70,000 debentures held by the National Telephone Co. The new issue would be one of 99,990 6 per cent. cumulative preference shares, and the prospectus would be issued on February 26th. Instead of the £70,000 debentures which were being redeemed, it was their intention to issue £50,000 5 per cent. first mortgage debentures, and these had already been spoken for and would be taken up as soon as they were ready to issue them. Another change which had taken place in connection with the company was that the National Telephone Co., who were half owners of the concern, were, according to agreement, paid off on January 1st last, and the 50,000 ordinary shares held by them were taken over by Messrs. L. M. Ericsson & Co., Stockholm, and their friends. He was sorry that their good friends, the National Telephone Co., had been forced through circumstances to retire, and during the past two years he had wondered to what extent this would affect their company. Regarding this, the Postmaster-General had stepped into the breach in a very large way, and had placed orders with them to a greater extent than they had ever dreamed of from the National Telephone Co. If it was a fact that the Post Office was to extend the telephone service at the rate stated in the Press, then the prospects for the future were very bright for telephone manufacturers. Certainly there was plenty of room for extension when they considered that in this country there were less than 700,000 telephones installed, and in the United States there were over 8,000,000. In Europe we were also sadly behind. Stockholm, a city much smaller than Birmingham, had one telephone for every 4·7 of its inhabitants; whereas Birmingham, a much wealthier city, had one for every 73 of its inhabitants; most of our other cities were in the same state. In regard to their accounts, the result of the year's working was an excellent one, namely, a net profit of £27,144, or 27 per cent. on the capital, and this, after heavy depreciation of the capital assets. The working expenses to gain this result had only increased slightly from 1909, when the net profit was £10,500. The balance-sheet showed a very healthy state of affairs. It contained not 1d. of "water." No amount was standing on the books in respect of the patent rights and goodwill, which they considered to be valuable assets of the concern. They had had the capital assets at the factory valued by Messrs. Fuller, Horsey, Sons & Cassell, and the value they put upon these was £116,768, whereas the amount standing on the books for these same assets was £86,897.

Mr. Harold Sands seconded the adoption of the report, which was carried unanimously.

**Continental Notes.**—Belgium.—The Société d'Electricité du Borinage, of Paturages, is increasing its capital to £100,000.

Switzerland.—La Société de la Fabrique d'Accumulateurs Oerlikon, of Oerlikon, Zurich, is declaring a dividend of 20 per cent. for the last financial year, the same as for the preceding 12 months.

## Lancashire United Tramways, Ltd.

The seventh ordinary general meeting of this company was held on Tuesday at Winchester House, E.C., under the chairmanship of the Hon. Arthur Stanley, M.P.

The Chairman, in moving the adoption of the report, said it was gratifying to state that there was a considerable improvement in the working of the combined undertaking over the year 1910. Their traffic receipts had increased by £2,261, and the earnings per car-mile amounted to 7·97d., this being the highest figure they had yet earned. The sale of electrical energy, as indicated last year, had made good progress, and showed an improvement of £900. Having obtained additional consumers in January, the current year should show a further increase of revenue from this source. The managing of their car advertising had again proved successful, the total revenue amounting to £988, being an increase of £90 over the previous year, and the expenses of this department had decreased by £91. Finally, their receipts had benefited by an increased dividend on the St. Helens holding and sundry interest to the extent of £638. The expenses showed a decrease of £1,472. This was due principally to the reduction in energy used by the cars through the installation of meters, and to economies effected in generating costs. Their expenses were as low as it was possible to work with efficiency, and compared favourably with any undertaking in the country. The claims experienced in carrying their public liability risk had proved satisfactory, and they had consequently decided to continue the arrangement for a further period. The net result of the year's operation was that in the three companies there was a profit of £19,185, against £13,824 last year, or an increase of £5,361. The sum of £3,000 had been placed to a general reserve account in the South Lancashire Tramways Co., as owing to the transfer of the generating station and other assets to that company it was essential that a reserve fund should be built up by them. A balance in profit and loss account of £121 had been carried forward. In the Lancashire Light Railways Co., Ltd., after placing £1,000 to renewals account, £924 had been carried forward. The combined total at the credit of depreciation, general reserve, and profit and loss accounts of the companies was £10,393. He hoped they would think the result showed satisfactory progress. Of course, they had been favoured with fine weather, but otherwise they had not had very exceptional advantages, and it was clear that the volume of traffic was gradually, but steadily, increasing on their lines. He would only add that they had a very good provident society amongst their men, and they were doing their best to see if they could not become an approved society under the new Act. It would be very advantageous if they could do so, so that their men could manage their own affairs. Like every other person throughout the country, they were hoping that the threatened coal strike would be averted, because they would undoubtedly feel the evil effects. He was glad to say that they had made a certain amount of provision, and that the strike could go on for a few weeks without causing them any great inconvenience.

Sir Joseph Beecham seconded the motion.

Mr. Hogg said he took it that the additional profit made was disposed of by writing off depreciation.

The Chairman said it was put to reserve in the South Lancashire Tramways Co.

Replying as to the position of the company in the event of a coal strike, the Chairman said he did not know definitely how long their coal would last. He supposed that they would close down their repairing shops and run the service as long as they could. A big part of their service consisted of workmen's cars, and if the strike came that service would not be wanted.

Another Shareholder asked why it was the company placed £2,000 to the reserve fund of the South Lancashire Tramways Co., as it rather looked like a contradictory principle. They were really in a better position than the accounts would tend to show.

The Chairman said the reason why they had put the £2,000 in the South Lancashire tramways was that they had already transferred the generating station to that company, in which they held all the shares. The depreciation account was in that company before, and therefore they left it there.

The report was adopted and the retiring directors were re-elected.

**South Metropolitan Electric Light and Power Co., Ltd.**—The warrants for dividends payable on February 28th on the 7 per cent. cumulative first preference shares, and 6 per cent. cumulative second preference shares (for the half-year ended December 31st, 1911) have been posted.

**Mansfield and District Tramways, Ltd.** — The directors have declared a dividend of 4 per cent. on the ordinary shares for 1911, placing £1,200 to reserve for depreciation, &c., and carrying forward £1,132.

**Mackay Companies.**—The regular quarterly dividend of 1¼ per cent. on the common shares is recommended, payable on April 1st.

**Urban Electric Supply Co., Ltd.**—A petition will be heard on March 12th, at the Law Courts in London, for confirming a special resolution reducing the capital of the company from £800,000 to £640,000.

**Ascot District Gas and Electricity Co.** — The accounts for 1911 show a profit of £5,709 on the gas department, and of £1,243 on the electricity section of the company's operations. The dividend declared is at the rate of 5½ per cent. for the year.

## North Metropolitan Electrical Power Distribution Co., Ltd.

THE directors report for the year ended December 31st, 1911, states that the revenue amounted to £15,806, an increase of £1,217, compared with the previous year. After deducting all expenses chargeable to revenue, including debenture interest, there remains a surplus of £4,383, making with the balance of £331 brought forward, a total of £4,714. The directors recommend a dividend at the rate of 5 per cent. per annum, requiring £2,500, placing to the credit of the depreciation account, £2,000, and carrying forward £214. The expenditure upon capital account during the year amounted to £1,828, of which £1,526 was in respect of extensions of mains and installations upon consumers' premises.

*Barnet Electric Supply.*—The revenue for the year amounted to £5,637, compared with £5,490 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 20,250 30-watt lamps. A public lighting agreement for a period of eight years from July 1st, 1911, has been entered into with the local authority.

*Enfield Electric Supply.*—The revenue for the year amounted to £3,056, compared with £3,080 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 16,700 30-watt lamps.

*Hertford Electric Supply.*—The revenue for the year amounted to £3,787, compared with £3,467 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 18,700 30-watt lamps.

*St. Albans Electric Supply.*—The revenue for the year amounted to £3,148, compared with £2,482 during 1910. The installations connected to the mains at December 31st last were approximately equivalent to 22,650 30-watt lamps.

*General.*—The additional connections made during the year to the mains in the four districts represented the equivalent of 7,781 30-watt lamps, making a total connection at the end of the year of approximately 78,300 lamps. The number of units sold during the year was 1,159,323, which, compared with the previous year's figure of 1,027,365, was an increase of approximately 13 per cent.

| | Barnet. | Enfield. | Hertford. | St. Albans. | Total. |
|---|---|---|---|---|---|
| Purchased in B.T. units .. | 528,673 | 203,211 | 261,870 | 261,733 | 1,255,487 |
| Sold—Public lamps .. | 51,819 | — | 6,673 | — | 58,492 |
| By contract .. .. | 306,228 | 43,262 | 67,670 | 121,721 | 539,081 |
| Private consumers by meter .. .. | 135,964 | 144,409 | 163,302 | 118,075 | 561,750 |
| Total sold .. .. | 494,011 | 187,671 | 237,645 | 239,796 | 1,159,323 |
| Total not accounted for .. | 34,662 | 15,540 | 24,025 | 21,937 | 96,164 |
| Public lamps.. .. .. | 198 | — | 13 | — | 211 |
| Max. supply demanded .. | 333 kw. | 164 kw. | 171 kw. | 186 kw. | — |

The meeting will be held to-day, March 1st, at the Electrical Federation Offices, W.C.

## London Electric Supply Corporation, Ltd.

THE Earl of Crawford, chairman, presided on Friday at Winchester House, E.C., over the meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 309) said that the balance which the board had to deal with this year was £49,463, as compared with £39,272 last year. The result of the year's working was a profit of £61,411, or an increase of £10,191 over last year. It was proposed to pay an extra ½ per cent. on the ordinary shares, place £5,000 to the contingencies account, and so replace the sum which they had to withdraw in 1910; add £5,000 to the reserve fund, and increase the amount carried forward by £526. They considered the year's working satisfactory, for although the units sold showed an increase of 57 per cent., yet nearly the whole of this large increase was for energy supplied for power purposes at very low rates, yielding proportionately small profits. Seven years ago their average receipts for every unit sold were over 4d., whereas at the present time they were not 2d., the decrease being over 50 per cent.; and it spoke well for the efficiency and keenness and zeal of the engineering staff that they had been able during the same period to reduce the costs of production by nearly 40 per cent. No less than 21 per cent. of this decrease had been accomplished within the year under review. A satisfactory feature of the decrease in the cost of production was that it was obtained without the assistance of the new turbine plant which was being installed, and the first set only commenced running about the middle of December. Further reductions in cost were anticipated in the current year, when the turbine plant would be running in full. The units sold to the London and Brighton Railway Co. for traction purposes showed an increase of 73 per cent. Owing to the success of the electrification of portions of the suburban system of the railway, further extensions would be opened in the course of a month or two, and they anticipated a large increase in the supply of power for that purpose during the current year. Since the service was started in January, 1909, they had, with the exception of one breakdown which lasted five minutes, owing to a fuse giving way at a critical period, given an uninterrupted supply. This was a fine record, and in connection with it he would like to read an extract from a paper by Mr. Philip Dawson, the consulting engineer of the Brighton Co., before the Institution of Civil Engineers. Mr. Dawson said "He did not like to sit down without stating how extremely satisfactory the supply of current to the Brighton Railway has been as obtained from the London Electric Supply Corporation. In the early days when the Brighton Railway first started experimenting, and before the trains were running for public traffic they probably gave the London Electric Supply Corporation some very difficult loads to cope with. He was glad to say they received practically a perfect supply, and the voltage had been so steady that it could have been used for ordinary lighting purposes without any ground for complaint. There has been no breakdown or failure of any form or description since they commenced running experimentally two years ago." He need not say that this was extremely high praise from such an authority, and they were very proud of it, and especially were they proud of the staff which had accomplished it. The supply of power for industrial purposes also showed a satisfactory increase, the units having increased from 3,300,000 to 6,213,000. He was pleased to say that this supply continued to increase, as manufacturers were beginning to realise the economy and facility of driving machinery by electric power, as compared with steam. Many of the large manufacturers in their area had discarded the whole of their steam plant, and had effected considerable economies in doing so. Generally speaking, the year had been one of progress, and the prospect was distinctly hopeful that the progress would continue. They were within the shadow of a great strike. They had grave difficulty with the railway trouble last year, and were within a narrow shave of running out of coal. This time they had taken more precautions, and at the present time they had six weeks' supply of coal upon the premises.

MR. R. STEWART BAIN (managing director), in seconding the motion, said the capital expenditure for the year was £73,022. This was principally for the new plant and mains in connection with the Brighton Railway Co.'s contract, and also included two large motor generators and three rotary converters to meet the increasing demand for industrial power supply. The amount spent for mains for the year was £15,490, which included about 11½ miles of new mains about equally divided between the new railway mains and the new three-phase power mains for industrial purposes. The total length of mains now laid was 190 miles. The units sold were nearly seven millions more than last year; the increases being 3,478,510 units for traction, or about 73 per cent.; 2,900,183 for industrial power purposes or about 87 per cent. increase; and 539,865 units for lighting purposes, or about 10 per cent. The receipts per unit in each division were again less than last year, but the cost of production also showed a large decrease. The works cost last year was ·48d. per unit as compared with ·56d. in the previous year, a reduction of over 14 per cent., and the total costs were ·82d. per unit as compared with 1·08d., or a reduction of about 21 per cent. The units sold for power purposes other than traction again showed a large increase; the increase during the year being 87 per cent., and they had every reason to believe this business would go on increasing. Coal showed an increase of £8,000, this being the principal increase in the expenditure, and it was owing to the increased number of units sold. The actual cost of coal per unit sold was 0·30d., as compared with ·32d., a decrease of rather over 6 per cent. This was the lowest cost of coal they had so far achieved, but when the new turbine plant was running regularly, they expected to still further reduce this, provided that there was no abnormal increase in the price of coal, owing to strikes. The average price paid for the coal during the year was 10s. 10½d., as compared with 10s. 6d. per ton last year. Wages, repairs and maintenance, stores, &c., showed a small increase, due to the larger number of units generated, but no material increase had taken place in any other items in the revenue account. He mentioned last year that they and other electric supply companies were threatened by a Bill promoted in Parliament by the Underground Railways, but they were able to come to a satisfactory arrangement with the promoters, and thus they avoided the expense of opposing the Bill. They did not anticipate that they would be put to the expense of opposing any Bills during the present session of Parliament. He would, in conclusion, confirm the chairman's remarks as to the efficiency and zeal of the staff generally, and especially of the engineering staff, under Mr. Partridge, to whose keenness and energy they owed the low costs shown in the accounts.

MR. D. HANKEY, whilst so far satisfied with the report, pointed out that the shareholders were receiving a very small return on their capital, and he suggested that if instead of placing £5,000 to the contingency the board had paid an extra 1 per cent. on the ordinary shares, it would enable them to issue further preference stock, which would be required during the year, at par.

Replying to these and other questions, MR. BAIN said they anticipated capital expenditure during the year of between £50,000 and £60,000. They were obliged to go to financiers for advice as to issuing capital, and their advice did not agree with the view expressed by Mr. Hankey. They were still going on with the litigation with the Westminster Electric Co.

The report was adopted, and a dividend of 2½ per cent. on the ordinary shares was declared.

**Bastian Meter Co., Ltd.**—In their report for the year ending December 31st, 1911, the directors express regret that the trading results of the previous year had not been maintained, chiefly owing to a reduction in prices. The sum of £300 having been written off patents and goodwill, the net amount of profit is £309, plus £646 brought forward, making £955. The directors recommend the payment of the 6 per cent. dividend on the cumulative preference shares, amounting to £121, and also a 2½ per cent. dividend on the ordinary shares, amounting to £248 for the year ending, carrying forward £587. At the meeting held at the Inns of Court Hotel, Holborn, on February 22nd, the report was adopted and the dividends were declared.

**W. T. Henley's Telegraph Works Co., Ltd.**—Subject to audit the directors have decided to recommend a dividend on the ordinary shares at the rate of 15 per cent., free of income-tax, including the interim dividend of 5 per cent., paid September 1st last. This is the same rate as for the year 1910.

## Notting Hill Electric Lighting Co., Ltd.

THE directors' report for the year ended December 31st, 1911, states that the expenditure on capital account has been increased during the past year by £4,075, so that it now stands at £247,407. The expenditure on capital account exceeds the receipts by £38,054. The cost of the joint station to date has amounted to £224,340, and joint debenture stock amounting to £227,500 has been issued. This stock is subject to a cumulative sinking fund, which now amounts to £46,438 invested in trustee securities. The following table shows the progress of the company :—

| | Equivalent of 8-c.p. lamps connected. | Profit. |
|---|---|---|
| 1908 .. .. .. .. | 168,885 | £19,484 |
| 1909 .. .. .. .. | 180,908 | £20,859 |
| 1910 .. .. .. .. | 189,885 | £22,002 |
| 1911 .. .. .. .. | 199,156 | £23,557 |

The number of consumers is now 3,513, and with the exception of 29 they are supplied at 200 volts. The gross revenue for the year was £43,059, showing an increase of £2,028, and the net profit for 1911 is £1,555 above that of 1910. From the net profit of £23,767 have to be deducted the following sums :—Depreciation, renewal, and reserve fund, £3,000 ; debenture and other interest, £2,413 ; Kensington and Notting Hill joint debenture stock—interest, £2,411 ; sinking funds, £1,456 ; leaving a balance available for dividend of £14,486. Both classes of 6 per cent. preference shares have already received their full dividend, which absorbs £8,136 and leaves a balance of £6,350 available for dividend on the new 1s. ordinary shares. The directors therefore recommend the payment of a dividend on those shares of 4s. 6d. per share, less tax, and that the balance of £619 be carried forward. The scheme of rearrangement of the share capital which was passed by the shareholders during the year, was confirmed by the High Court of Justice on June 13th, 1911, the capital now being as follows :—Share capital £201,352 10s., divided into 2,998 6 per cent. cumulative preference shares of £10 each ; 17,602 6 per cent. non-cumulative preference shares of £10 each ; 27,050 ordinary shares of 1s. each ; 11,402 of the non-cumulative preference shares, and the whole of the other shares have been issued, and are fully paid up. Under the rearrangement of the capital each of the old ordinary preference shares received in exchange one fully-paid 6 per cent. cumulative preference share and the right to subscribe at par for one 1s. ordinary share. Each of the old ordinary shares received in exchange one fully-paid 6 per cent. non-cumulative preference share and the right to subscribe at par for one 1s. ordinary share. Each of the founders' shares received in exchange one fully-paid 6 per cent. non-cumulative preference share and the right to subscribe at par for 24 1s. ordinary shares. All the new shares were taken up, and the rearrangement of capital was duly carried through.

The meeting is called for March 5th.

| | |
|---|---|
| Units generated and purchased .. .. .. .. .. | 3,255,199 |
| Units sold—Public lamps .. .. .. .. .. | 103,985 |
| Private consumers by meter.. .. .. .. | 2,232,864 |
| Total sold .. .. .. .. .. .. | 2,336,849 |
| Units used on works .. .. .. .. .. .. | 25,591 |
| Total units accounted for .. .. .. .. .. | 2,962,440 |
| Units expended in distribution transformers and accumulators .. .. .. .. .. .. .. | 892,759 |
| Number of public lamps .. .. .. .. .. | 53 |
| Total maximum supply demanded in kw... .. .. .. | 1,696 |

## Bath Electric Tramways, Ltd.

THE Hon. Sir James Sivewright, K.C.M.G. (chairman), presided on February 21st at Winchester House, E.C., at the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 311), the CHAIRMAN said he thought the company had to be congratulated upon the fact that it was the second year of its existence so far as traffic and profits were concerned. The summer was a good one, and verified what he had repeatedly said before, that the success of a tramway depended upon the management and upon the weather. Judging from the results, they believed they had a management second to none in the kingdom, and the weather also having been favourable, they were in the position of having had a revenue of £43,834, being an increase of £1,462 over that of the preceding year. With satisfactory results such as that, naturally the question which occurred to every shareholder, and especially the preferred shareholders, was as to why they were not paying a dividend. They had received a good many letters from shareholders, some couched in temperate language and some a little intemperate, which was not, perhaps, unnatural. No one would more heartily welcome a dividend on the preferred ordinary shares than himself, for he held no debentures or preference stock, but paid £10,000 in cash for 10,000 preferred ordinary shares when the company was formed, and he held every one of them that day. No one, therefore, would benefit more than himself if a dividend were paid on the preferred ordinary shares. The position, however, was that they were paying off the bank loan out of revenue, and now the loan, which formerly stood at £28,000, was reduced to between £22,000 and £23,000. It had been urged that they did once pay a dividend when the loan was bigger, and that was true. At that time the loan was a new one, and they anticipated being able to replace it with debentures, but that could not be done, and so the bank had objected to the payment of ordinary dividends until the loan was substantially reduced. They had done everything possible to replace the loan, and had approached most of the trust companies in London, Edinburgh and Paris, but the objection which these companies urged was not that the undertaking was not good security, but that the nature of the security was such that it could not be quoted. The security they offered was what would be called an "A" debenture security, it being a first charge on certain works which were outside the present bond, and a second charge on works at present within the bond. He was glad to say that recently a quarter had been suggested from which it was hoped they might be able to place this, and, if that could be done, they would resume the payment of a dividend on the preferred ordinary shares. He had received a letter from Mr. Charles White, of Dundee, who said he thought that a small dividend should be paid on the preferred ordinary shares ; asking if anything could not be done to attract more passengers ; and suggesting that as ½d. fares had paid well in Dundee, it would be well if the board consulted Mr. Peter Fisher, the tramways manager in Dundee. With regard to the points raised, they would like to pay a dividend if the bank would permit them. They welcomed any suggestion to increase the traffic, and had run a service of motor-'buses with that object in view. Mr. Fisher had been written to, and he pointed out that, of course, there was a vast difference between thickly populated towns like Dundee and Glasgow and a city like Bath. The board would have very seriously to consider before introducing ½d. fares, for whilst it was easy to reduce fares, it was not so easy to raise them. The foundry they took over last year, was paying 15 per cent. on the capital involved, and the works were so full of orders that they were seriously considering an extension. With regard to their system, the board were satisfied with its efficient working. They, of course, recognised the fact that rails would not last for ever, but at present the system was in first-rate order. It might be that, five or six years hence, they might have to replace a good number of the rails, but they had already put away £4,000 for that purpose, and could face the situation with perfect equanimity at the present moment. They had improved the system a good deal by anchors, the cost of which had been charged to revenue, although it might well have been made a capital charge. From a table published in one of the journals giving the results of the working of 17 tramway companies and 77 corporations owning tramways, he found that there was only one company which had a lower operating cost per car-mile, viz., Cork, and in that city the lighting was amalgamated with the working of the tramways. The ratio in Cork was 5·01d. per car-mile, whilst Bath came out at 5·136d. Of the local authorities only one came out lower, viz., Leith. The average working expenses of the 17 companies was 6·2d. per car-mile, and of the 77 corporations, 6·46d. The working expenses per car-mile of the Bath Co., if they deducted the London expenses and directors' fées, was 4·788d., whilst if they included these items it was 5·368d. He thought the shareholders were to be congratulated on this, and having been connected with many companies, he would say he did not know that he had ever met a better staff than they had. The board were making every effort to reduce expenses, and he hoped that before long the preferred ordinary shareholders would be receiving a dividend on their holdings.

MR. E. CAILLARD seconded the motion.

MR. FEDDEN called attention to the auditors' certificate, wherein they gave the opinion that "subject to the question of depreciation," they were satisfied. He asked if the board could not do something to get a clean balance sheet.

MR. JACOBSON (the auditor) pointed out that the board had satisfied him that the undertaking was well maintained, but there was the question of obsolescence. The auditors pointed that out, and it was a question now merely between the shareholders and the board.

The CHAIRMAN said he had told them of the money spent in the maintenance of the system, and they were gradually reducing the debentures, and putting aside a reserve for depreciation which, in his opinion, was amply sufficient.

The report was then adopted, and the retiring director re-elected.

## Waste Heat and Gas Electrical Generating Stations, Ltd.

THE directors' report to January 31st, 1912, states that the profits earned by the company during the year, after deducting administration expenses and interest paid on calls in advance, amount to £25,071 (against £21,915 in 1910), less £7,500 transferred to the credit of reserve account, as compared with £7,000. The balance brought forward from the previous year was £6,048, and the profits available are £23,619, as compared with £18,518. The directors propose to declare a dividend at the rate of 8 per cent. for the year ending January 31st, 1912, which will absorb £15,664. Of this an interim dividend at the rate of 5 per cent. per annum for the half-year ending July 31st was paid in August, 1911, amounting to £4,326 ; there remains to be carried forward £7,955. It is proposed to pay the balance of the dividend on March 15th, 1912, less income-tax. The negotiations for erecting further waste heat generating stations which were reported to be proceeding at the date of the last annual report, had so far advanced early in the year as to require the issue of further capital to meet the cost of construction. Accordingly the company in general meeting increased the authorised share capital from £250,000 to £350,000, and in May, 1911, the directors offered for subscription 160,000 shares at 21s. per share. The capital offered was largely over-subscribed, and the whole of the issue has now been called up. The directors deducted the expenses incurred in connection with this issue and the cost of increasing the authorised capital from the premiums received, and have transferred the balance amounting to £3,851 to the credit of reserve account. The total of the reserve account, including the transfer from the premiums and the amount set aside out of the profits of the year, now amounts to £24,351. The company's new generating plant at Grangetown for the utilisation

of exhaust steam from the works of the Tees Furnace Co., Ltd., has been completed and is now in operation. The new stations at Port Clarence and Ayresome, each of which has a capacity of 3,200 H.P., are still in course of construction but are expected to be completed during the next two months. The construction of the proposed station at Redcar, mentioned in the recent prospectus, has not yet begun, as the negotiations have not been concluded. The Bankfoot Power Co., Ltd., have completed the extensions to their Bankfoot generating station and are constructing a further station at Bowden Close. To meet the cost of construction of these new stations the Bankfoot Co. have issued £50,000 of debentures and have increased their capital by the issue of 40,000 shares of £1 each. This company has subscribed for £10,000 of these debentures, and also for £20,000 of the new share capital on which the sum of 2s. 6d. per share was paid before the end of the financial year under review. All the company's stations have been maintained in efficient repair during the year, and provision has been made against certain exceptional expenditure at the Weardale generating station. As the operations of the company have considerably extended since its incorporation, the directors propose to ask the shareholders at the annual general meeting to-day, March 1st, to increase the sum divisible as remuneration to £600 a year.

## Bruce Peebles & Co., Ltd.

Mr. F. E. Andrews presided at the annual general meeting of this company, held at Edinburgh on February 23rd. In moving the adoption of the report (see Elec. Rev., p. 309), he reminded those present that he had always stated that the critical time for the new Bruce Peebles Co. would be the third year of its existence. It could not fail, therefore, to be very gratifying to them to learn from the accounts that they had succeeded in getting over that period in a satisfactory manner, and that in spite of the grave difficulties they had managed to turn the corner and had, in the comparatively short time of three years, converted the large annual loss at which the works were being run into a profit sufficient to provide for the interest on the debentures and still leave a small surplus. The mortgage debentures had been reduced from £75,000 to £69,050, £5,950 in all having been redeemed in accordance with the terms of the trust deed, so that they were now saving practically £300 per annum on this account in respect of interest. The amount of unsecured debentures, or income bonds as they should preferably be called, was now £66,447, and this was the total amount issued under the scheme of reconstruction. Shares to a total value of £111,181 had also been issued in the same connection. Under the scheme it was originally estimated that the new company would have to issue about £90,000 of the unsecured debentures, and about £150,000 in shares, to creditors of the old company in settlement of claims, but a certain number of these claims could not be substantiated and the total amount of unsecured debentures and shares actually issued was therefore correspondingly reduced to the figures mentioned—even with this appreciable reduction the legacy they had inherited from their predecessors, in the shape of heavy capitalisation, was obviously a serious burden and a great handicap. But all matters in connection with the old company were now finally completed; application was being made to the Court to close the liquidation, and he hoped that that was the last time there would be any necessity to refer to it. The output of the works during 1911 was appreciably larger than during the previous year, therefore though the debts they owed, which were merely their current accounts, were naturally somewhat higher than before, the debts owing to them had gone up very considerably, so that at the end of the year there was a difference in their favour of nearly £34,000; this was a very satisfactory position. But though they naturally expected an increasing business like theirs to lock up a large portion of their cash resources, he felt constrained, in connection with this large amount of debts owing to them, to mention the unreasonably prolonged periods for payment which were so frequently stipulated in electrical engineering contracts. The trend had certainly been for the terms imposed on manufacturers to become more and more onerous until they had now reached a point that was distinctly unreasonable, and he was of opinion that the time had arrived when it was essential for all concerned to make a firm stand against conditions that were inequitable. In this and various other important matters affecting them, he was hopeful that the British Electrical and Allied Manufacturers' Association would be able to exercise a beneficent influence. Practically all the leading companies and firms had now joined, and the Association was taking energetic steps to remove some of the unreasonable and unnecessary difficulties under which the whole industry had laboured and struggled for many years past. Though the volume of work given out during 1911 was certainly somewhat larger than during 1910, it could not be said that there had been any real improvement in the conditions of the electrical trade, the demand for electrical machinery being still far short of the possible output of the existing works. In consequence, the unreasonable competition to which he had referred in previous years still continued, and it had been a difficult task to keep the works supplied with orders showing a reasonable profit. He was not without hope, however, that with the continually increasing use of electrical apparatus for all kinds of purposes, the demand would gradually approximate more nearly to the capacity for supply, and prices in consequence adjust themselves to a level that would enable some return to be made on the large amount of capital invested in the industry. It must not, however, be forgotten that they always had to face competition from foreign manufacturers, who were able to import free into their markets, whilst British firms were effectively shut out of their own countries by the prohibitive tariffs. However, they had to take things as they were and make the best they could of them, therefore they had continued to give special attention to the extension of their business both at home and abroad. In the home market they had concentrated their efforts largely on selling the class of machines which their works were especially able to turn out at favourable prices, and their endeavours in this respect had been fairly successful. But their chief aim had always been to push their business abroad, where, although the cost of obtaining orders was necessarily larger than in this country, the prices obtainable were not so absurdly low as here. He informed them last year of the steps that they had taken with regard to South Africa, India, &c., and that they had their own men permanently residing in those countries. With regard to Canada, also, they found the demand for electrical plant already so great, and the field such a promising one, that they decided to send out one of their engineers, who had a wide experience in their sales department here, to reside permanently in that country. The amount of work already obtained was encouraging, and he thought that they might look forward to increasingly satisfactory results in the future. In conjunction with some other firms, they made arrangements to be adequately represented in China, but the upheaval in that country had naturally put a stop to business. Once the revolution was settled, however, there was little doubt that progress would be both great and rapid, and they would then be in a good position to take advantage of the improved circumstances. Their policy all through had been the somewhat prosaic but very sound one of endeavouring to steadily build up a circle of satisfied customers in all parts of the world, so as to ensure a regular flow of orders into their workshops, and one of the healthiest and most encouraging signs of the past year was the very considerable increase in the number of their customers. The critical third year was passed, the enormous annual loss at which these works were formerly run had been converted into a profit, the machinery they turned out had a world-wide reputation for excellence, and there seemed to be a fair prospect of a reasonable volume of business, and though he was not very fond of attempting to forecast the future, he regarded the outlook for 1912 hopefully, and trusted that a year hence they would be able to show even more satisfactory results than those now presented to them.

## Hove Electric Lighting Co., Ltd.

The directors' report for the year ended December 31st, 1911, contains the following particulars of the progress of the company:—

| Year. | Houses. | Equiv. in 8-c.p. lamps. | Units sold. | Gross revenue. | Net revenue. |
|---|---|---|---|---|---|
| 1907 .. | 1,579 | 104,8•3 | 1,019,469 | £28,331 | £12,693 |
| 1908 .. | 1,•76 | 114,135 | 1,134,994 | 24,695 | 13,463 |
| 1909 .. | 1,320 | 122,946 | 1,192,504 | 25,205 | 13,581 |
| 1910 .. | 1,949 | 129,217 | 1,178,165 | 2•,991 | 15,400 |
| 1911 .. | 2, 28 | 1 8,200 | 1,139,328 | 24,840 | 14,457 |

There is a decrease in gross revenue of £1,151 and a reduction in working costs of £208, the net result of the year's working being a profit of £14,457, compared with £15,400 in the preceding year. With the addition of the balance £862, brought forward from 1910, and other items, the amount to the credit of net revenue account is £15,569 (compared with £15,764), from which must be deducted the dividend on the preference shares paid September 1st, 1911 (£588), the interim dividend on the ordinary shares at the rate of 8 per cent. per annum (£2,825), a provision for debenture interest accrued, and income-tax, leaving a surplus of £9,564 now available. The directors propose to place £1,500 to the renewals and depreciation account and £3,000 to the sinking fund, to set aside £588 for accrued preference dividend to December 31st last, and to declare a final dividend for the six months on the ordinary shares, payable on April 15th next, at the rate of 10 per cent. per annum, making 9 per cent. for the year. The amount carried forward, after providing for the directors' extra remuneration of £307, is £637. The renewals and depreciation account, with the addition above mentioned, will now stand at £25,604. The sinking fund account, with the above addition of £3,000 and £1,355 received by way of dividends on investments, will now amount to £43,513. The expenditure during the year on capital account has amounted to £5,292, and the machinery, buildings and mains of the company have been kept in good repair.

The meeting will be held on March 6th.

## Telegraph Construction and Maintenance Co., Ltd.—

The directors' report and accounts show a net profit of £87,515, after charging the interest on the debentures. To this sum must be added £107,578 brought forward from last year, making a total of £195,093. From this amount is deducted the interim dividend of 5 per cent., paid July 20th, 1911, amounting to £22,410, leaving £172,683 to be dealt with. Of this sum the directors propose to distribute a dividend of £1 4s. per share, together with a bonus of 6s. per share, absorbing £56,025, being at the rate of 12½ per cent., and making, with the amount already paid, a total dividend and bonus for the year of £2 2s. per share, or 17½ per cent., free of income-tax, and to supplement the reserve fund by £10,000 (making it £85,000), leaving £106,658 to be carried forward. The general business of the company during the past year has been satisfactory. The company's works and steamships have been maintained in their usual state of efficiency. As promised at the last half-yearly meeting, the shareholders were to be asked at yesterday's meeting to decide whether half-yearly meetings should be discohtinued. The Earl of Selborne and Sir James Pender, Bart., offer themselves for re-election as directors.

## Northampton Electric Light and Power Co., Ltd.

THE annual meeting was held at Northampton on Thursday last week, Alderman F. H. Thornton, presiding.

In moving the adoption of the report, the CHAIRMAN said the sale of current advanced during the year from £16,899 to £19,404, an increase of £2,505. The reserve fund had been increased to £3,000, and the depreciation fund now stood at £20,604. All round the figures were larger and more satisfactory than last year. The directors considered they had got practically a model generating station, and during the year three deputations from various parts of the country had made inspections. A deputation from Norwich had inspected the turbine, one of the first of its type, because it ran not only on high pressure but also on exhaust steam; a deputation from West Bromwich had inspected the coal elevators; and a deputation from Bridlington had been to see the equalisers. The company had made great extensions during the year, and they considered that the Weston Favell branch would prove important for the sale of current. They had laid in a large stock of coal and would, he thought, be able to meet any emergency in that respect. Alderman W. TOMES seconded the motion, which was carried unanimously.

Dividends as recommended by the directors were declared, and it was decided that the remuneration of the directors should in the future be £300 per annum, an advance of £50. Thanks were passed to the secretary, the chief engineer, and the staff for their services, and a vote of thanks to the chairman concluded the meeting.

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**Prospectuses.**—*Coal Substitute, Ltd.*—The list opened on Tuesday, and was to close on Wednesday, for subscriptions for 140,000 shares of 10s. each in this parent company formed to acquire the invention of "a proved efficient substitute for coal which contains no coal or peat," and is stated to be saleable from 13s. per ton. It is said that the raw material can be produced in this and almost all other countries in abundance, but there is a contract mentioned under which the company will be able to obtain "any quantity of the raw material up to 30,000,000 tons per annum at 1s. 6d. per ton at Lisbon." It is claimed that the calorific effect of the fuel is equal to that of "good household coal," "and it lasts longer." Messrs. Sulman & Picard, chemists and assayers, who have tested the fuel, gave the following result after drying at 212° F.:—Volatile hydro-carbons and combined moisture, 46·65 per cent.; fixed carbon, 45·80 per cent.; ash, 7·55 per cent. = 100 per cent. The price to be paid for the invention and patent rights and the benefit of the contract named above, is £65,000, as to £5,000 in cash, £30,000 in shares, and the balance in shares or cash.

*Sudd Fuel (Suddite), Ltd.*—This company has also offered an issue of 120,000 7 per cent. participating convertible preference shares of £1 each at par. The company is to acquire the benefit of an agreement with the Sudan Government, giving the company the exclusive right to manufacture solid fuel from papyrus um soof and other aquatic plants, known as "Sudd," until 1922; also to acquire the exclusive right to use in Egypt and the Sudan the special machinery and process necessary, designed by Prof. Dr. Paul Hoering, of Berlin, and the plant and machinery now at Khartoum, North. The consideration to be paid to Soudan Industries, Ltd., promoters and vendors, is £118,500, payable as to £18,500 in cash and £100,000 in shares. It is stated that a laboratory test shows Suddite to contain 3·3 per cent. moisture, 7·7 per cent. ash, and 89 per cent. combustible matter.

*Portland Railway, Light, and Power Co.*—The list closes to-day in an issue, at 95½ per cent., of $16,000,000 first and refunding mortgage 5 per cent. sinking fund gold bonds (1942) convertible into stock.

*The British L.M. Ericsson Manufacturing Co., Ltd.*—This company has this week been before the public with an issue at par of 99,990 cumulative 6 per cent. preference shares of £1 each. The list opened on Monday and was to close yesterday. The circumstances of the issue are related in our report of the company's meeting given on another page to-day.

**Falkirk Electric Construction Syndicate, Ltd.**—Mr. A. W. Tait presided at this company's meeting, and, referring to the success of the business, said it had certainly been more prosperous than during the previous year. The report of the directors, which, with the audited accounts of the syndicate and the Falkirk Tramways Co., was adopted, showed that, because of the satisfactory nature of the accounts, the directors had decided to write off in one year the whole of the expenses and discount in connection with the issue of debentures, amounting to £1,983. The profit of the Falkirk and District Tramways Co., amounting to £4,183, was transferred to the syndicate by way of dividend, while the balance at the credit of the profit and loss account of the syndicate was £4,331. The directors recommended a dividend at the rate of 4 per cent., less income-tax, on the share capital, which left £708 to be carried forward. The gross profit and loss account of the Tramway Co. showed that the traffic receipts had amounted to £17,036, while traffic, power, maintenance, and other expenses totalled £9,734, which left £7,571 to be carried forward. The total profit, after deductions for interest on mortgages and loans, and legal expenses in connection with the opposition to the Falkirk Burgh Extension Order, depreciation and sinking fund, amounted to £4,183.

**Sao Paulo Tramway, Light and Power Co.**—A quarterly dividend at the rate of 10 per cent. per annum is announced.

**Oxford Electric Co., Ltd.**—The directors' report for the year ending December 31st, 1911, states that the revenue account shows a profit (including £970 brought forward from last year) of £15,481. After providing £2,041 for debenture and other interest, also writing off £872 on account of hire-purchase installations, the balance available for dividend is £12,568. The directors propose a dividend at the rate of 7½ per cent. per annum, less income-tax, on the ordinary share capital (whereof 3 per cent. was paid in September), £7,250; dividend (5 per cent. per annum) on the preference share capital (whereof 2½ per cent. was paid in September), £2,000; to credit of reserve and renewal of plant account, £2,173, leaving to be carried forward £1,145. Reserve and renewal of plant account has been charged with the cost of plant replaced. It is estimated that at December 31st last there was the equivalent of over 135,000 lamps connected to the mains. The lamp, heating and motive power connections have continued to increase satisfactorily. The plant has been maintained in thoroughly efficient order. With the object of effecting further economies, and to provide for the increasing demand, a Diesel engine with dynamo of 450-KW. capacity has been placed on order. The supply mains of the company have been extended in Charlbury, Hill Top, Minster, Portland and Southfield Roads, and in Stratford Street.

**Chelsea Electricity Supply Co., Ltd.**—The directors' report for 1911 states that the profit amounts to £37,500, which, with £2,298 brought forward and £1,450 for interest, makes a total of £41,248. After deducting interest on debenture stock £7,875, interim dividend 6 per cent. on preference shares £900, interim dividend on ordinary shares at the rate of 4 per cent. per annum £4,944, there remains a balance of £27,530, which the directors recommend shall be appropriated as follows: To credit of reserve for renewals, depreciation and contingencies, £13,180; to credit of debenture stock premium redemption fund, £704; to amount written off cost of extinction of founders' shares, £1,089; to amount written off cost of purchase of Cadogan Electric Light Co., £1,000; to final dividend on the preference shares at the rate of 6 per cent. per annum, making 6 per cent. for the year, £900; to final dividend on the ordinary shares at the rate of 6 per cent. per annum, making 5 per cent. for the year, £7,415; leaving to be carried forward £3.241. The number of 8-C.P. lamp equivalents connected was 282,376, an addition of 10,289 during the year, and the total number of units sold was 4,016,478, being 128,458 less than for 1910. The regular demand for the past year has shown a satisfactory increase, the decrease being due to the discontinuance of a large temporary supply of power.

**Llanelly and District Electric Lighting and Traction Co., Ltd.**—The directors report that the profit for 1911, including £56 brought forward, and after payment of loan and debenture interest charges, is £4,585. Out of this the interim dividend on the 6 per cent. cumulative preference shares to June last, amounting to £1,761, has been paid, leaving £2,824. The directors recommend the dividend on the 6 per cent. cumulative preference shares for the half-year to December £1,800, carrying forward £1,024. The tramways were completed early in August, 1911, so that the full system was only in operation for about five months.

**Giant's Causeway and Portrush Electric Tramway Co.**—The annual meeting was held in Portrush on February 23rd, Provost Traill, D.L., presiding. The directors' report stated that the receipts had increased from £3,877 to £4,107, with one exception the highest on record since the starting of the company, and the net profits from £1,381 to £1,546. The number of passengers had increased from 132,789 in 1910 to 136,395 in 1911. The balance, £262, against the net revenue account last year, had been turned into a balance of £167 in its favour in this year's account for the first time in 25 years. As a reserve power, to meet the contingency of another summer's drought, the directors had erected an additional electric generating station at the depôt, Portrush, at a cost of £500. The profits from the year's working would have far outrun those of any previous year had it not been for the unexampled drought, as a result of which the water supply to the turbines had to be carefully conserved. The engineer's report stated that the permanent way, the power plant—electric and steam—and the rolling stock, had been maintained in an efficient condition. The number of miles run by electricity had been 33,407, at a working cost of 3¾d. per mile run. The number of miles run with steam engines had been 4,048, at a working cost of 1s. 4d. per mile run. The report was adopted.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

Ados, Ltd.
Electric Timber-Seasoning and Preservation Co., Ltd.
Improved Electric Glow Lamp Co., Ltd.
London and Provincial Electric Construction Co., Ltd.
McPhail & Simpson's Dry Steam Patents Co., Ltd.

**County of London Electric Supply Co., Ltd.**—The directors have declared a final dividend on the preference shares at the rate of 6 per cent. per annum, less income-tax, and on the ordinary shares at the rate of 8 per cent. per annum, less income-tax, for the half-year to December 31st, making 6 per cent. for the year on the ordinary shares. £25,000 has been placed to reserve for depreciation, against £20,000 last year.

## MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

### Wednesday, February 28th.

| CHEMICALS, &c. | | Latest Price. | Fortnight's Inc. or Dec. |
|---|---|---|---|
| a Acid, Hydrochloric | per cwt. | 5/- | .. |
| a " Nitric | " | 22/- | .. |
| a " Oxalic | per lb. | 2¾d. | .. |
| a " Sulphuric | per cwt. | 5/6 | .. |
| a Ammoniac Sal | " | 42/- | .. |
| a Ammonia, Muriate (large crystal) | per ton | £29 10 | .. |
| a Bleaching powder | " | £5 10 | .. |
| a Bisulphide of Carbon | " | £18 | .. |
| a Borax | " | £16 10 | .. |
| a Copper Sulphate | " | £23 | £1 inc. |
| a Lead, Nitrate | " | £25 | .. |
| a " White Sugar | " | £25 | £2 5 inc. |
| a " Peroxide | " | £32 | .. |
| e Methylated Spirit | per gal. | 2/6 | .. |
| a Potassium, Bichromate, in casks | per lb. | 3½d. | .. |
| a Potash, Caustic (80/82 %) | per ton | £20 5 | .. |
| a " Chlorate | per lb. | 3½d. | .. |
| a " Perchlorate | " | 4½d. | .. |
| a Potassium, Cyanide (98/100 %) (for mining purposes only) | " | 7½d. | .. |
| a Shellac | per cwt. | 68/- | .. |
| a Sulphate of Magnesia | per ton | £4 10 | .. |
| a Sulphur, Sublimed Flowers | " | £6 10 | .. |
| a " Recovered | " | £5 10 | .. |
| a " Lump | " | £5 5 | .. |
| a Soda, Caustic (white 70/72 %) | " | £10 5 | .. |
| a " Chlorate | per lb. | 3¾d. | .. |
| a " Crystals | per ton | £3 5 | .. |
| a Sodium Bichromate, casks | per lb. | 3d. | .. |
| **METALS, &c.** | | | |
| b Aluminium Ingots, in ton lots | per ton | £85 | .. |
| b " Wire, in ton lots | " | £102 | .. |
| b " Sheet, in ton lots | " | £120 | .. |
| p Babbitt's metal ingots | " | £38 to £145 | .. |
| c Brass (rolled metal 2" to 12" basis) | per lb. | 7¼d. | ¼d. inc. |
| c " Tube (brazed) | " | 10¼d. | ¼d. inc. |
| c " " (solid drawn) | " | 8¼d. | ¼d. inc. |
| c " Wire, basis | " | 7¼d. | ¼d. inc. |
| c Copper Tubes (brazed) | " | 10¾d. | ¼d. inc. |
| c " " (solid drawn) | " | 10d. | ¼d. inc. |
| g " Bars (best selected) | per ton | £79 | .. |
| g " Sheet | " | £79 | .. |
| g " Rod | " | £79 | .. |
| d " (Electrolytic) Bars | " | £66 5 | .. |
| d " " Sheets | " | £68 5 | .. |
| d " " Rods | " | £71 5 | .. |
| d " " H.C. Wire | per lb. | 8¾d. | .. |
| f Ebonite Rod | " | 5/8 | .. |
| f " Sheet | " | 4/9 | .. |
| n German Silver Wire | " | 1/11 | .. |
| h Gutta-percha, fine | " | .. | .. |
| h India-rubber, Para fine | " | 4/7½ | ¼d. inc. |
| j Iron Pig (Cleveland warrants) | per ton | 49/7 | 8½d. inc. |
| l " Wire, galv. No. 8, F.O. qual. | " | £14 | .. |
| g Lead, English Pig | " | £16 2 6 to £16 5 | 2/6 inc. |
| m Manganin Wire No. 28 | per lb. | 6/6 | .. |
| g Mercury | per bot. | £8 7 6 | .. |
| o Mica (in original cases) small | per lb. | 6d. to 2s. | .. |
| o " " " medium | " | 2/6 to 4/- | .. |
| o " " " large | " | 4/6 to 8/6 | .. |
| p Phosphor Bronze, plain castings | " | 11d. | .. |
| p " " rolled bars & rods | " | 1/0½ | .. |
| p " " rolled strip & sheet | " | 1/1 | .. |
| o Platinum | per oz. | 185/- | .. |
| d Silicium Bronze Wire | per lb. | 9½d. | .. |
| r Steel Magnet, in bars | per ton | £55 | .. |
| g Tin, Block (English) | " | £197 to £199 | £1 dec. |
| n " Wire, Nos. 1 to 16 | per lb. | 2/4½ | ½d. inc. |
| p White Anti-friction Metals | per ton | £45 to £150 | .. |
| k Zinc, Sh't (Vieille Montagne bnd.) | " | £30 7 6 | .. |

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

**Stock Exchange Notices.**—The Stock Exchange Committee have appointed special settling days as under:—

Friday, March 1st.—Puebla Tramway Light and Power Co.—Scrip, fully and partly paid, for $3,000,000 prior lien 5 per cent. 50-year gold bonds.

Wednesday, March 6th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 10,000 7 per cent. cumulating participating preference shares of £1 each, fully paid (Nos. 727,012 to 737,011).

Thursday, March 7th.—Marconi's Wireless Telegraph Co., Ltd.—Further issue of 12,989 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 737,012 to 750,000).

And ordered the under-mentioned securities to be quoted in the Official List:—

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 10,000 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 727,012 to 737,011); and 12,989 7 per cent. cumulative participating preference shares of £1 each, fully paid (Nos. 737,012 to 750,000).

Mexican Light and Power Co., Ltd.—£1,000,000 5 per cent. second mortgage 50-year bonds (Nos. A 1 A 10,000) of £100 each, in lieu of the scrip.

## STOCKS AND SHARES.

Tuesday Evening.

The shadow of a coal strike is still lying over most of the markets in the Stock Exchange at the time of writing, although hopes run high of a peaceful settlement after all. Prices, as a matter of fact, have held their positions with a good deal of tenacity; perhaps with more than might have been expected in the circumstances. So far as Electric issues are concerned, it may be said that the labour difficulty has had little or no influence upon quotations.

Metropolitan Railway Consolidated stock and City and South London Ordinary stock have been racing neck and neck for the honour of the biggest advance this week. The improvements are 3 and 2 respectively. The rumour connecting the City and South London line with the Crystal Palace we mentioned last week; while another one that is doing duty is that the company will shortly be included within the scope of the Underground Electric Railways combine. Metropolitan Ordinary has been bought for the same reason as that last given in connection with the City and South London, and quite possibly all the Underground lines will be joined up in course of time, although, at present, negotiations may be disclaimed by one company and another. Central London Ordinary is 1 down. Underground Electric Railway shares rose ⅛, and the Income bonds 2, it being understood that the bull account has been substantially, if still only partially, reduced. British Electric Tractions are steady, with rises in both Preference stocks. South Metropolitan Preference rose ⅛, but the Metropolitan Tramways descriptions are unchanged.

In the English Electricity Supply group, Charing Cross Ordinary continue to improve, and Bromptons put on ½, the latter bringing the price to 8¾ middle. Westminsters are harder at 8⅝, St. James's rose to 8¼, and Edmundsons' Preference improved ⅛ to 3⅛; the only shares to look back being Metropolitan Ordinary, which are somewhat easier. There has been a little inquiry for the Ordinary shares of the Edmundsons' Company, which has put the price up to 11s., speculative buying being stimulated by the expectation that in the course of a year or two the company might even pay a dividend upon these.

In the Foreign section, the news concerning the revolution in Mexico is read more gravely than has been the case hitherto, and most of the Mexican Light and Power issues show falls on the week. The declines range from ½ to 2; but we understand that the prices were marked down more in apprehension of selling than by reason of actual realisation. Confidence, of course, has been shaken in Mexican investments, and there is a lack of support to take small lines of shares when they come to market, which accentuates the prevalent feeling of depression. Mexican Light and Power fell 2, Mexico Trams losing 3 points. The feature of strength in this section is Kaministiquia Power Gold bonds, which are up no less than 5 points. Canadian General Common lost a point, and Shawinigan Water went back after its brilliant rise of last week. Canadian General Electric lost 2, and Montreal Light, Heat and Power fell 1. There was a slight weakening in Rio Trams, but the bonds are both better.

Telegraph and Telephone issues are, in the main, steady enough. The feature is a rise of ⅜ in West India & Panama Telegraphs, the report of American buying being sedulously circulated. We have already referred to the suggestion that the United States Government should take over the control of the whole telegraph system of the country, and the idea is that an influential syndicate has been formed in order to buy up the West India & Panama with a view to re-selling it to the Government later on. What foundation there may be for this statement we are unable to say, but the report has been quite sufficient to rally the price to the extent indicated. Eastern Ordinary shed the point it gained last week, but Anglo "A" continue to advance slowly.

The excitement over Marconis has subsided to a slight extent, and the shares went down on the eve of the carry-over, at which it was made obvious that a heavy bull account still exists in the shares. After touching 4⅜ sellers, however, the price recovered to 4⅛, the Preference moving up in sympathy. National Telephone Deferred is again a good market, with a rise of 3 points to its credit on the week. In other Telephone and Telegraph issues there is no feature.

Amongst Manufacturing shares, Castner-Kellners picked up part of their drop, but Babcocks are heavy and have given way to 6⅛, in spite of extravagant expectations with reference to the dividend announcement. Willans & Robinson continue in request, the shares and the debenture stock all improving this week, and another noticeable movement is a rise of 2 in British Westinghouse 4 per cent. Debenture stock.

The Rubber market has been quiescent, prices being fairly well maintained, though business has sunk to small proportions.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.**—The directors have declared a dividend of 4½ per cent. for the year to December 31st (on account of which an interim dividend of 2 per cent. was paid in July last) on the ordinary shares. This compares with a total of 4 per cent. for 1910.

**Mirrlees Watson Co., Ltd.**—The directors have declared a dividend for 1911 of 10 per cent. and a bonus of 5 per cent., less income-tax.

**United Alkali Co., Ltd.**—A dividend of 4s. per share, as last year, is announced, £75,000 being placed to reserve and £37,000 carried forward.

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for | | Closing Quotations Feb. 27th. | Rise + or Fall — | Present Yield p.c. |
|---|---|---|---|---|---|---|
| | * | 1910. | 1911. | | | £ s. d. |
| Bournemouth & Poole, Ord. | 10 | 5½ | 5† | 8¼ — 9¼ | .. | 5 18 11 |
| Do. 4½ % Pref. | 10 | 4½ | 4½ | 8¼ — 9¼ xd | .. | 4 14 9 |
| Do. Second 6 % Pref. | 10 | 6 | 6 | 10½ — 11 xd | — ¼ | 5 9 1 |
| Do. 4½ % Deb. Stock | Stock | 4½ | 4½ | 101 —102 | .. | 4 8 8 |
| Brompton & Kensington, Ord. | 5 | 10 | 9† | 8½ — 9 | + ½ | 5 11 1 |
| Do. 7 % Cum. Pref. | 5 | 7 | 7 | 7¾ — 8¼ | .. | 4 4 10 |
| Central Electric Supply, 4 % Guar. Deb. | 100 | 4 | 4 | 98 —101 | .. | 3 19 3 |
| Charing Cross, West End & City | 5 | 5 | 5† | 4 — 4½ | + ⅛ | 5 11 1 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4¼ — 4⅝ xd | .. | 4 17 4 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 4½ | 4½ | 8⅜ — 4½ | .. | 5 9 1 |
| Do. Do. 4 % Deb. | 100 | 4 | 4 | 93 — 96 | .. | 4 3 4 |
| Chelsea, Ord. | 5 | 5 | 5 | 4¼ — 4⅜ | .. | 5 5 3 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| City of London, Ord. | 10 | 7 | 6† | 13⅜ — 14½ | .. | 4 19 1 |
| Do. 6 % Cum. Pref. | 10 | 6 | 6 | 12 — 13 | .. | 4 12 4 |
| Do. 5 % Deb. | Stock | 5 | 5 | 117 —121 | .. | 4 2 8 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| County of Durham, 5 % First Mort. Deb. | Stock | 5 | 5 | 87 — 89 | .. | 5 12 4 |
| County of London, Ord. | 10 | 5 | 4† | 9¼ — 10 | .. | 5 0 0 |
| Do. 6 % Pref. | 10 | 6 | 6 | 11⅛ — 11⅝ | .. | 5 3 3 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 107 —109 | .. | 4 2 7 |
| Do. 4½ % Second Deb. | Stock | 4½ | 4½ | 101 —104 | .. | 4 6 7 |
| Edmundson's, Ord. | 5 | Nil | Nil | ⅜ — ⅝ | .. | Nil |
| Do. 6 % Cum. Pref. | 5 | Nil | Nil | 2⅛ — 3⅜ | + ⅛ | Nil |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 87 — 90 | .. | 5 0 0 |
| Folkestone | 5 | 6 | 6† | 4½ — 5 | .. | 6 0 0 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 4⅝ — 5⅛ | .. | 4 17 7 |
| Do. 4½ % First Deb. | 100 | 4½ | 4½ | 93 — 96 | .. | 4 13 9 |
| Hove | 5 | 9 | 8† | 6¾ — 7¼ | .. | 6 4 2 |
| Kensington & Knightsbridge, Ord | 5 | 9 | 9 | 6¾ — 7¼ | .. | 6 4 2 |
| Do. 4 % Deb. | Stock | 4 | 4 | 92 — 95 | .. | 4 4 3 |
| Kent Elec. Power, 4½ % Deb. | Stock | 4½ | 4½ | 80 — 84 | +2 | 5 7 2 |
| London Electric, Ord. | 3 | 2 | 2⅓ | 1⅛ — 2 | .. | 2 19 11 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4⅝ — 5 | .. | 6 0 0 |
| Do. 4 % First Mort. Deb. | Stock | 4 | 4 | 88 — 92 | + ½ | 4 7 0 |
| Metropolitan | 5 | 5 | 4† | 3⅝ — 4⅛ | — ⅛ | 6 1 3 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4¼ — 4⅝ | .. | 4 17 4 |
| Do. 4½ % First Mort. Deb. | Stock | 4½ | 4½ | 99 —104 | .. | 4 6 7 |
| Do. 3½ % Mort. Deb. | Stock | 3½ | 3½ | 84 — 87 | .. | 4 0 6 |
| Midland Electric Corporation 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 96 — 98 | +1 | 4 11 10 |
| Newcastle-on-Tyne | 5 | 4 | 4† | 3½ — 4 | .. | 5 0 0 |
| Do. 5 % Pref., Non-Cum. | 5 | 5 | 5 | 4 — 4⅛ | .. | 5 11 1 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 99 —102 | .. | 4 18 0 |
| Notting Hill, 6 % Non-Cum. Pref. | 10 | .. | .. | 9¾ — 10¾ | .. | .. |
| Oxford | 5 | 7½ | 6† | 6⅛ — 6⅝ | .. | 5 9 5 |
| St. James' and Pall Mall, Ord. | 5 | 10 | 10 | 8 — 8½ xd | + ⅛ | 5 17 8 |
| Do. 7 % Pref. | 5 | 7 | 7 | 6¾ — 7¼ xd | .. | 4 16 7 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 85 — 87 | .. | 4 0 6 |
| Smithfield Markets, Ord. | 5 | Nil | 2 | 1⅜ — 1⅝ xd | .. | .. |
| South London, Ord. | 4 | 5 | 5 | 3¼ — 3½ | .. | 6 3 1 |
| Do. 5 % First Mort. Deb. | 100 | 5 | 5 | 98 —101 | .. | 4 19 0 |
| South Metropolitan, 7 % Pref. | 1 | 7 | 7 | 1 — 1⅛ | .. | 6 4 5 |
| Do. 4½ % First Deb. Stock | 100 | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Urban, Ord. | 5 | 5 | .. | ⅜ — ½ | .. | .. |
| Do. 5 % Cum. Pref. | 5 | 5 | .. | 2⅜ — 3⅜ | .. | .. |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 87 — 89 | —1 | 5 1 2 |
| Westminster, Ord. | 5 | 10 | 10 | 8⅝ — 8⅞ | + ⅛ | 5 12 8 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4⅛ — 5⅛ | .. | 4 6 9 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| | | | | | | |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. | 5 | 6 | 6 | 5¾ — 6 | .. | 5 0 0 |
| Calcutta, Ord. | 5 | 8⅛ | 7† | 6½ — 7 | .. | 6 1 5 |
| Do. 5 % Pref. | 5 | 5 | 5 | 5 — 5½ | .. | 4 15 3 |
| Calgary Power, 1st Mort. Bds. | 100 | 5 | 5 | 92½ — 94½ | .. | 5 5 3 |
| Canadian Gen. El. Com. | $100 | 7 | 7† | 114 —118 | —2 | 5 18 8 |
| Do. 7 % Pref. | $100 | 7 | 7 | 117 —121 | .. | 5 15 8 |
| Cordoba Lt., Power and T., Ord. | 1 | 3 | 3† | ⅞ — 1 | .. | 3 0 0 |
| Do. 5 % Deb. | 100 | 5 | .. | 95 — 98 | .. | 5 2 0 |
| Elec. Lt. and P. of Cochabamba, 6 % Bonds | 100 | 6 | 6 | 91 — 93 | .. | 6 9 0 |
| Elec. Supply Victoria, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 83 — 86 | .. | 5 16 3 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| Kalgoorlie Elec. P. and L., Ord. | 10/- | Nil | .. | 3/6 — 3/9 | .. | Nil |
| Do. 6 % Pref. | 1 | 6 | 6 | 5/- — 5/3 | .. | 8 0 0 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 108 —110 | +5 | 4 11 0 |
| Madras, Ord. | 5 | .. | .. | 2⅜ — 3⅜ | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 101½ —103½ | + ½ | 4 16 7 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 84 — 96 | —1 | 5 16 3 |
| Mexican Lt. & Power, Common | $100 | 4 | 4† | 83 — 85 | —2 | 4 14 2 |
| Do. 7 % Cum. Pref. | $100 | 7 | 7 | 105 —107 | —1½ | 6 10 10 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 94 — 96 | — ½ | 5 4 2 |
| Monterey Rly. Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 89 — 91 | .. | 5 9 11 |
| Montreal, Lt., H. and Power | $100 | 7 | 8 | 192 —197 | —1 | 3 11 1 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5 | .. | 39 — 41 | .. | 12 3 10 |
| River Plate, Ord. | Stock | 10 | .. | 250 —260 | .. | 3 16 11 |
| Do. 6 % Non-Cum. Pref. | Do. | 6 | 6 | 110 —115 | .. | 5 4 4 |
| Do. 5 % Deb. Stock | Do. | 5 | 5 | 100½ —102½ | .. | 4 17 7 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| Shawinigan Water, Capital | $100 | 4 | 5† | 129 —131 | —2 | 3 16 4 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 107 —109 | .. | 4 11 9 |
| Do. 4½ % Per. Deb. | Stock | 4½ | 4½ | 103½ —105½ | + ½ | 4 5 4 |
| Toronto Power, 4½ % Deb. | Do. | 4½ | 4½ | 99½ —101½ | .. | 4 8 8 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 99½ — 94½ | .. | 5 5 10 |
| Victoria Falls Power, Pref. | 1 | Nil | 11¼d. | 1⅛ — 1⅜ | .. | .. |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | 6 | 6 | 107 —109 | .. | 5 10 1 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Amazon Telegraph | 10 | Nil | 4† | 7¼ — 7¾ | .. | .. |
| Do. 5 % Deb. Red. | Stock | 5 | 5 | 97 — 99 | .. | 5 1 0 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8† | 144 —146 | .. | 5 9 7 |
| Do. Collat. Trust | $1000 | 4 | 4 | 93½ — 95½ | .. | 4 3 9 |
| Anglo-American Telegraph | Stock | 3⅜ | 3 | 66 — 68 | .. | 4 8 6 |
| Do. 6 % Pref. | Do. | 6 | 6 | 109⅜ —110⅜ | .. | 5 8 4 |
| Do. Def. | Do. | 30/- | 30/- | 25½ — 26 | + ⅛ | 5 15 5 |
| Anglo-Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 102 —104 | .. | 4 16 1 |
| Chili Telephone | 5 | 7 | .. | 7¼ — 7½ | .. | 4 13 4 |
| Commercial Cable, Stlg. 4 % Deb. | Stock | 4 | 4 | 86 — 88 | .. | 4 10 11 |
| Cuba Telegraph | 10 | 6 | 6† | 10½ — 11½ | .. | 5 6 8 |
| Do. 10 % Pref. | 10 | 10 | 10 | 17 — 18 | .. | 5 11 1 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4† | 3½ — 3⅝ | .. | 5 6 8 |
| Do. 10 % Cum. Pref. | 5 | 10 | 10 | 8 — 8½ | .. | 5 17 8 |
| Do. 4½ % Debs. | 50 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Direct United States Cable | 10 | 4½ | .. | 7⅛ — 8 | .. | 5 12 6 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 5† | 136 —139 | —1 | 5 0 9 |
| Do. 3½ % Pref. Stock | Do. | 3½ | 3½ | 83 — 85 | .. | 4 2 4 |
| Do. 4 % Mort. Deb. | Do. | 4 | 4 | 100 —102 | .. | 3 18 5 |
| Eastern Extension | 10 | 7 | 5† | 13⅜ — 13⅞ | .. | 5 0 11 |
| Do. 4 % Deb. | Stock | 4 | 4 | 99 —101 | .. | 3 19 3 |
| East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. | 25 | 4 | 4 | 99 —101 | .. | 3 19 3 |
| Globe Telegraph and Trust | 10 | 5⅞ | 6† | 11 — 11½ | .. | 5 2 2 |
| Do. 6 % Pref. | 10 | 6 | 6 | 13½ — 13⅝ | .. | 4 8 1 |
| Great Northern Telegraph | 10 | 18 | 5† | 34 — 38 | .. | 5 9 1 |
| Indo-European Telegraph | 25 | 13 | 5† | 56½ — 58½ | .. | 5 10 2 |
| Mackay Companies Common | $100 | 5 | 5† | 81 — 83 | .. | 6 0 6 |
| Do. 4 % Cum. Pref. | $100 | 4 | 4 | 70 — 73 | .. | 5 9 7 |
| Marconi's Wireless Telegraph | 1 | 5 | .. | 4⅜ — 4⅝ | + 1/16 | .. |
| Do. 7 % Cum. Partic. Pref. | 1 | 16 | .. | 4 — 4⅛ | + 1/16 | .. |
| Monte Video Telephone, Ord. | 1 | 6 | 6 | 1 — 1⅛ | .. | 5 6 3 |
| Do. 5 % Pref. | 1 | 5 | 5 | 3/32 — 5/32 | — 1/32 | 5 10 6 |
| National Telephone, Pref. | Stock | 6 | 6† | 99½ —102½ | .. | 5 17 1 |
| Do. Def. | Do. | 6 | 6† | 124 —126 | +3 | 4 15 3 |
| Do. 6 % Cum. 1st Pref. | 10 | 6 | 6 | 9¼ — 10 | .. | 6 0 0 |
| Do. 6 % Cum. 2nd Pref. | 10 | 6 | 6 | 9¼ — 10 | .. | 6 0 0 |
| Do. 5 % Non-cum. 3rd Pref. | 5 | 5 | 5 | 5⅛ — 5⅞ | .. | 4 12 0 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 103 —104 | .. | 4 6 6 |
| Oriental Telep. and Elec. | 1 | 2 | .. | 1⅜ — 1⅝ | .. | 4 11 5 |
| Do. 6 % Cum. Pref. | 1 | 6 | 6 | 1½ — 1⅝ | .. | 4 16 10 |
| Do. 4 % Red. Deb. | Stock | 4 | 4 | 87½ — 89½ | .. | 4 9 5 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 98½ —100½ | .. | 8 19 7 |
| Reuter's | 8 | 5 | 5† | 10½ — 11½ | .. | 3 9 7 |
| Submarine Cables Trust | Cert. | 6 | 6 | 130 —133 | .. | 4 10 3 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| United River Plate Telephone | 5 | 8 | 8 | 7⅜ — 7⅝ | .. | 5 4 11 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 5⅜ — 5⅝ | .. | 4 8 11 |
| West Coast of America | 2½ | 2½ | 2½ | 1¼ — 1⅜ | .. | 3 11 5 |
| Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. | 100 | 4 | 4 | 98 —100 | .. | 4 0 0 |
| West India and Panama Teleg. | 10 | 1½ | 1½† | 4⅛ — 4⅜ | + ⅛ | .. |
| Do. 6 % Cum. 1st Pref. | 10 | 6 | 6 | 10⅞ — 11⅛ | + ⅛ | 5 5 6 |
| Do. 6 % Cum. 2nd Pref. | 10 | 6 | 6 | 9⅞ — 10⅜ | .. | 5 6 8 |
| Do. 5 % Debs. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Western Telegraph, Ltd. | 10 | 7 | 6† | 13½ — 14 | .. | 5 0 0 |
| Do. 4 % Deb. | Stock | 4 | 4 | 99 —101 | .. | 3 19 3 |
| Western Union Tel., 4 % Bnds. A | $1000 | 4 | 4 | 106 —109 | .. | 3 13 5 |
| Do. 4½ % Fdg. Bonds | $1000 | 4½ | 4½ | 101½ —104½ | + ½ | 4 6 2 |

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1910. | Dividends for 1911. | Closing Quotations Feb. 27th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Bath Trams, Pref. Ord. .. .. | * 1 | Nil | Nil | ⅛ — ⅜ | . | Nil |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 11/16 — 13/16 | .. | 7 5 6 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 80 — 85 | .. | 5 5 11 |
| Brit. Elec. Trac., 6 % Pref. .. | 100 | .. | .. | 14 — 16 | .. | .. |
| Do. Do. Deferred .. | 100 | .. | .. | 8 — 10 | .. | .. |
| Do. Do. 6 % Cum. Pr'f. | 100 | .. | .. | 93 — 95 | +1 | .. |
| Do. 7 % Non-Cum. Pr'f. | 100 | .. | .. | 41½ — 43½ | + ½ | .. |
| Do. 5 % Perp. Deb. .. | 100 | 5 | 5 | 96 — 99 | .. | 5 1 0 |
| Do. 4½ % 2nd Deb. .. | 100 | 4½ | 4½ | 79 — 82 | .. | 5 8 5 |
| Central London Railway, Ord. | 100 | 3 | 3 | 68 — 70 xd | —1 | 4 5 9 |
| Do. Pref. .. .. .. | 100 | 4 | 4 | 83 — 85 xd | .. | 4 14 2 |
| Do. Def. .. .. .. .. | 100 | 2 | 2 | 58 — 60 xd | .. | 3 6 8 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 100 —102 | .. | 3 18 5 |
| City & South London, Ord. .. | 100 | 1½ | 1½† | 34 — 35 | +2 | 4 5 9 |
| Do. 5 % Pref., 1891 .. .. | 100 | 5 | 5 | 107 —109 | +1 | 4 11 9 |
| Do. Do. 1896 .. .. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Do. Do. 1901 .. .. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Do. Do. 1903 .. .. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 101 —103 | .. | 3 17 8 |
| Dublin United Trams, 6 % Pref. | 10 | 6 | 6 | 10⅞— 11⅜xd | .. | 5 2 2 |
| Great Northern & City, Pr'f. Ord | 10 | Nil | .. | 1⅛— 1⅜ | .. | Nil |
| Hastings Trams, 6 % Pref. .. | 5 | Nil | 3† | 1/16— 3/16 | .. | .. |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 73 — 78 | .. | 5 15 5 |
| Isle of Thanet Trams, 5 % Pref. | 5 | 2½ | 2½ | 2⅜ — 2⅝ | .. | 4 6 11 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 75 — 80 | .. | 5 0 0 |
| Lancashire United, 5 % Deb. .. | 100 | 5 | 5 | 82 — 84 | +1 | 5 19 1 |
| London Elec. Railw'ys, 4 % Deb. | 100 | 4 | 4 | 97 — 99 | .. | 4 0 10 |
| London United Trams, 5 % Pref. | 10 | Nil | .. | 3⅜— 4⅛ | .. | .. |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 75 — 78 | .. | 5 2 7 |
| Metropolitan Railway Consol. .. | 100 | 1⅜ | 1½ | 49½— 50 xd | +3 | 3 15 0 |
| Do. Surplus Lands .. .. | 100 | 2½ | 2½ | 68 — 70 xd | .. | 3 18 7 |
| Do. 3½ % Deb. .. .. | 100 | 3½ | 3½ | 90 — 92 | .. | 3 16 1 |
| Do. 3½ % Pref. .. .. | 100 | 3½ | 3½ | 85 — 87 xd | .. | 4 0 6 |
| Do. 3½ % Con. Pref. .. .. | 100 | 3½ | 3½ | 84 — 86 xd | .. | 4 1 5 |
| Metropolitan District Ord. .. | 100 | Nil | .. | 33⅜— 34⅛ | + ⅛ | Nil |
| Do. 6 % Deb. .. .. | 100 | 6 | 6 | 144 —146 | .. | 4 2 2 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Do. 4 % Prior Lien .. .. | 100 | 4 | 4 | 100 —102 | .. | 3 18 5 |
| Do. 4½ % First Pref. .. .. | 100 | 3⅜ | 4½ | 89 — 91 xd | .. | 4 18 11 |
| Do. 3½ % Gtd. .. .. .. | 100 | 3½ | 3½ | 76 — 78 | .. | 4 9 9 |
| Metropolitan Elec. Trams, Ord. | 1 | 5½ | 5† | 3⅞— 4⅛ | .. | 5 13 6 |
| Do. Def. .. .. .. .. | 1 | Nil | .. | 3/16— 5/16 | .. | Nil |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 3⅝— 3¾ | .. | 5 10 2 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 100½—102½ | .. | 4 17 7 |
| Potteries, Ord. .. .. .. | 1 | 2 | .. | ⅜ — ½ | —1/16 | .. |
| Do. 5 % Pref. .. .. .. | 1 | 5 | 5 | 7⅞— 8⅜xd | .. | 6 19 3 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 89 — 92 | .. | 4 17 10 |
| South Metro. Trams, 6 % Pref. | 1 | 6 | .. | ⅜ — ⅝ | + ⅛ | 6 17 2 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 72 — 77 | .. | 5 4 0 |
| Underground Elec. Railways | 10 | .. | .. | 2⅛— 2⅜ | + ⅛ | .. |
| Do. 4½ % Bonds .. .. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 6 % Income .. .. | 100 | 1 | 1½† | 76 — 78 | +2 | .. |
| Yorkshire (West Riding), Ord. | 5 | Nil | .. | ⅛ — ⅜ | .. | Nil |
| Do. 6 % Pref. .. .. .. | 5 | Nil | .. | 2⅛— 3⅛ | .. | Nil |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 81 — 85 | .. | 5 5 11 |

### ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. .. | 5 | 5 | 5⅝ | 5 — 5⅛ | .. | 5 4 9 |
| Do. 2nd Pref. .. .. .. | 5 | 5 | 5⅜ | 4⅞— 5⅛ | .. | 5 3 6 |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 93½— 95 | .. | 4 4 3 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 101½—103½ | + ½ | 4 7 0 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 103½—105½ | .. | 4 14 9 |
| Auckland Trams, 5 % Deb. .. | 100 | 5 | 5 | 102 —105 | .. | 4 15 3 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10⅞— 11⅛ | + ⅛ | 5 6 8 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Do. 5 % 2nd Deb. .. .. | 100 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Brisbane Trams Invt., Ord. .. | 5 | 8 | 8† | 8⅝— 9 | .. | 4 8 11 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 4⅞— 5⅛ | .. | 4 15 3 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| B. Columbia Elec. Rly., Def. .. | 100 | 8 | 8† | 136 —141 | .. | 5 13 0 |
| Do. Pref. Ord. .. .. .. | 100 | 6 | 6 | 117 —121 | .. | 4 19 2 |
| Do. 5 % Pref. .. .. .. | 100 | 5 | 5 | 108½—111½ | .. | 4 9 8 |
| Do. 4½ % 1st Mort. Deb. .. | 40 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| Do. 4½ % Vancouver Deb. .. | 100 | 4½ | 4½ | 102 —104 | .. | 4 6 7 |
| Do. 4½ % Con. Deb. .. .. | 100 | 4½ | 4½ | 103½—105½ | + ½ | 4 5 4 |
| Calcutta Trams, Ord. .. .. | 5 | 6 | .. | 5⅛— 5⅜ | .. | 5 4 4 |
| Do. 5 % Pref. .. .. .. | 5 | 5 | 5 | 4⅞— 5 1/16 | — 1/16 | 4 16 5 |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| Cape Electric Trams .. .. | 1 | Nil | 2½† | ⅜ — ½ | .. | .. |
| City Buenos Aires Trams (1904) | 5 | 5 | 5 | 5⅜— 5⅝ | .. | 4 5 1 |
| Do. 4 % Deb. .. .. .. | 100 | 5 | 5 | 101— 103 | .. | 4 17 3 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 93 — 98 | .. | 5 2 0 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 100 —103 | .. | 4 17 1 |
| Kalgoorlie Elec. Trams .. .. | 1 | Nil | .. | ⅞ — 1 1/16 | .. | Nil |
| Do. 5 % A Deb. .. .. | 100 | 5 | 5 | 91 — 94 | .. | 5 6 5 |
| Do. 6 % B Deb. .. .. | 100 | 5 | 6† | 58 — 62 | .. | 8 1 4 |
| La Plata Elec. Trms, Ord. .. | 1 | .. | .. | 31/32— 1 | .. | .. |
| Do. Pref. .. .. .. | 1 | 6 | 6 | 1⅛— 1 | .. | 6 0 0 |
| Lisbon Elec. Trams, Ord. .. | 1 | 5½ | 6† | 1 — 1⅛ | .. | 4 8 0 |
| Do. 6 % Pref. .. .. .. | 1 | 6 | 6 | 1 — 1⅛ | .. | 4 16 0 |
| Do. 5 % Deb. .. .. .. | 100 | 5 | 5 | 93½— 97½ | .. | 5 2 7 |
| Madras Elec. Tr. (1904), Deb. .. | 100 | 5 | 5 | 93½— 96½ | .. | 5 3 8 |
| Manaos Trams & Lt., 1st Deb. .. | 100 | 5 | 5 | 92 — 95 | .. | 5 5 3 |
| Manila Elec. R. and Ltg., Bonds | $1000 | 5 | 5 | 98¾—100½ xd | .. | 4 19 6 |
| Mexico Trams Com. .. .. | $100 | 7 | 7† | 117 —119 | —3 | 5 17 8 |
| Do. Gen. Con. 5 % Bonds .. | .. | 5 | 5 | 100 —102 | — ½ | 4 18 0 |
| Do. 6 % Bonds .. .. .. | 100 | 6 | 6 | 100½—102½ | — ½ | 5 17 1 |
| Para Elec. Rlys. & Lt., Ord. .. | 5 | 10 | 10 | 7⅞— 7⅝ | — 1/16 | 6 13 4 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 5 — 5⅛ | .. | 5 9 1 |
| Do. 5 % 1st Deb. .. .. .. | 100 | 5 | 5 | 97⅛— 99½ | .. | 5 0 6 |
| Perth (W.A.) Elec. Tr., Ord. .. | 1 | 2½ | .. | 1 1/16— 1 3/16 | + ⅛ | 1 18 1 |
| Do. 5 % 1st. Deb. .. .. | 100 | 5 | 5 | 101 —104 | +1 | 4 16 2 |
| Rangoon El. Tr. & Sup., Pref. .. | 5 | 6 | 6 | 5⅝— 5⅞ | .. | 5 2 2 |
| Do. 4½ % 1st Deb. .. .. | 100 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Rio de Janeiro Trams .. .. | $100 | 4½ | 5† | 116 —117 | — ½ | 4 5 6 |
| Do. 1st Mort. 5 % Bonds .. | .. | 5 | 5 | 102 —103 | + ½ | 4 17 1 |
| Do. 5 % Mort. Bonds .. | 100 | 5 | 5 | 99 —100 | + ½ | 5 0 0 |
| Sao Paulo Tram, Lt. and P. .. | $100 | 10 | 10† | 197 —199 | .. | 5 0 6 |
| Do. 5 % 1st Deb. .. .. | $500 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Singapore Trams, 5 % Deb. .. | 100 | 5 | 5 | 81 — 84 | .. | 5 19 1 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 93 — 95 | .. | 5 5 3 |
| Un. Elec. Trams Monte Video .. | 5 | 6 | 7 | 5⅛— 5⅝ | .. | 5 6 8 |
| Do. 6 % Pref. .. .. .. | 5 | 6 | 6 | 5⅛— 5⅝ | .. | 5 11 7 |
| Do. 5 % 1st Deb. .. .. | 100 | 5 | 5 | 98⅜—101½ | .. | 4 18 6 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 104 —106 | .. | 4 4 11 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. .. .. .. .. | 1 | Nil | 6 | ⅜— ½ | .. | .. |
| Do. 6 % Pref. .. .. .. | 1 | 9 | 6 | 8⅜— 8¾ | .. | 7 2 2 |
| Babcock & Wilcox .. .. | 1 | 26 | 24† | 6⅜— 6⅝ | — ⅛ | 3 17 0 |
| Do. Pref. .. .. .. | 1 | 6 | 6 | 1⅛— 1⅜ | .. | 3 13 10 |
| B.I. & Helsby Cables .. .. | 5 | 10 | 8† | 6⅞— 7⅛ | .. | 6 17 11 |
| Do. Pref. .. .. .. | 5 | 6 | 6 | 5⅞— 6⅛ | .. | 4 16 0 |
| Do. Deb... .. .. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 94 — 97 | .. | 4 12 9 |
| British Westinghouse, Pref. .. | 3 | Nil | .. | ⅛ — ⅜ | .. | Nil |
| Do. Deb... .. .. .. | 100 | 4 | 4 | 63 — 66 | +2 | 6 1 3 |
| Do. 6 % Prior Lien .. .. | 100 | 6 | 6 | 102 —105 | .. | 5 14 3 |
| Browett, Lindley, Ord. .. .. | 1 | Nil | .. | 1/6—2/- | .. | Nil |
| Do. Pref. .. .. .. .. | 1 | Nil | .. | 5/- —6/- | .. | Nil |
| Brush, Ord. .. .. .. .. | 2 | Nil | .. | 0 — ¼ | .. | Nil |
| Do. 7 % Pref. .. .. .. | 2 | Nil | .. | 0 — ¼ | .. | Nil |
| Do. 4½ % Deb. .. .. .. | 100 | 4½ | 4½ | 56 — 61 | .. | 7 7 7 |
| Do. 4½ % Second Deb. .. | 100 | 4½ | 4½ | 37 — 42 | .. | 10 14 4 |
| Callender's Cable .. .. .. | 5 | 15 | 10† | 9 — 93 | .. | 7 13 10 |
| Do. Pref. .. .. .. .. | 5 | 5 | 5 | 5 — 5⅛ | .. | 4 15 3 |
| Do. Deb... .. .. .. | 100 | 4½ | 4½ | 98½—100⅜ | .. | 4 9 7 |
| Casiner-Kellner .. .. .. | 1 | 17½ | 20 | 3 1/16— 3 3/16 | + 1/16 | 5 8 5 |
| Do. Deb... .. .. .. | 100 | 4½ | 4½ | 106 —110 xd | .. | 4 1 10 |
| Crompton & Co. .. .. .. | 8 | Nil | Nil | ⅛ — ⅜ | .. | Nil |
| Do. Deb... .. .. .. | 100 | 5 | 5 | 58 — 63 | .. | 7 7 1 |
| Dick, Kerr .. .. .. .. | 1 | 5 | .. | 3⅞— 3¾ | .. | 5 3 1 |
| Do. Pref. .. .. .. .. | 1 | 6 | 6 | 1 3/32— 1 5/32 | .. | 5 9 9 |
| Do. Deb... .. .. .. | 100 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Edison & Swan, A, £3 paid .. | 5 | Nil | .. | 1/16— 1/8 | .. | Nil |
| Do. fully paid .. .. .. | 5 | Nil | .. | 1/16— 2/16 | .. | Nil |
| Do. 4 % Deb. .. .. .. | 100 | 4 | 4 | 71 — 75 | .. | 5 6 8 |
| Do. 5 % Second Deb. .. .. | 100 | 5 | 5 | 77 — 80 | .. | 6 5 0 |
| Electric Construction .. .. | 2 | Nil | 2½† | ⅜ — 1 | .. | .. |
| Do. Pref. .. .. .. .. | 2 | 7 | 7 | 1⅝— 1⅞ | .. | 7 9 4 |
| Greenwood & Batley, Pref. .. | 10 | 7 | 7 | 7⅝— 8⅛ | .. | 8 5 8 |
| Do. Deb... .. .. .. | 100 | 5 | 5 | 94 — 96 | .. | 5 4 2 |
| General Electric, Pref. .. .. | 10 | 5 | 5 | 9 — 9½ | .. | 5 5 3 |
| Do. Deb... .. .. .. | 100 | 4 | 4 | 85 — 90 | .. | 4 8 11 |
| Henley's, Ord. .. .. .. | 5 | 15 | 10† | 11⅜— 12½ | .. | 6 2 5 |
| Do. Pref. .. .. .. .. | 5 | 4½ | 4½ | 5 — 5⅛ | + 1/16 | 4 5 9 |
| Do. Deb... .. .. .. | 100 | 4½ | 4½ | 104 —106 | .. | 4 4 11 |
| India-Rubber, G. & T. .. .. | 10 | 10 | .. | 10 — 12 | .. | .. |
| Do. Pref. .. .. .. .. | 10 | 5 | 5 | 9⅛— 10½ | .. | 4 17 7 |
| Telegraph Construction .. .. | 12 | 20 | 10† | 85⅞— 87½ | .. | 6 7 0 |
| Do. Deb... .. .. .. | 100 | 4 | 4 | 99⅛—101⅛ | .. | 3 18 10 |
| Willans & Robinson .. .. .. | 1 | Nil | .. | 1/16— 1/8 | + 1/16 | Nil |
| Do. Pref. .. .. .. .. | 5 | Nil | .. | 1/16— 1⅛ | + ⅛ | Nil |
| Do. Deb... .. .. .. | 100 | 4 | 4 | 61 — 64 | +2 | 6 5 0 |

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

## PROCEEDINGS OF INSTITUTIONS.

### Recent Developments in Steam Turbine Practice.

By K. Baumann.

(*Discussion on paper read before the* Institution of Electrical Engineers, *at Manchester, January 16th*, 1912. *For Abstract of paper, see page* 317.)

Mr. Gerald Stoney said he considered the paper the most important on steam turbines which had appeared for a long time. The necessity of dealing with high superheat and the prevention of trouble due to this high superheat—from differences of expansion, and also on account of the growth of cast-iron—was common both to the pure Rateau and to the Parsons turbines. There were two ways to get over the trouble of growth. One was to use an impulse wheel, in which, by the approximate adiabatic expansion of the steam, the temperature was reduced below a point where such growth was liable to take place. The other was to use material which would not distort permanently with superheated steam; a steel casting was such a material, and in all recent turbines of the pure Parsons type in which there was high superheat the centre portion of the casing was a steel casting. This had proved able to get completely over the trouble due to superheated steam. Alternatively, they used a Curtis wheel followed by the ordinary Parsons blading. Makers of turbines had to go with the fashion, and provide their customers with an impulse wheel, but in no case had Messrs. Parsons got a better steam consumption, or had the costs of manufacture been reduced, by the use of an impulse wheel. The maximum efficiency of a single row of blades was about 80 per cent., and this figure applied equally both to the Rateau and to the Parsons turbine. The maximum efficiency under the best conditions of a two-row Curtis wheel was 67 per cent., but they had found that under the conditions under which it had to work at the high-pressure end of a turbine, the efficiency was as low as 42 to 45 per cent., on account of the small arc of impingement and the high skin friction of the disk running in steam at considerable pressure. It wanted very short Parsons blades with very big clearances to get as low an efficiency as this: the high-pressure part of the pure Parsons turbine was practically always superior to this figure, and therefore it was possible to get the steam consumption of the pure Parsons turbine as a whole better than that of the disk and drum type. The disk and drum was working under the most favourable conditions in moderate sizes running at high speed, say, 750 to 1,500-kw. plants at 3,000 r.p.m., but when they came to low speeds, the result became much worse. For instance, a 1,000-kw. set at 1,500 r.p.m. as a disk and drum was decidedly worse than a pure Parsons machine. In comparing different sizes, it would have to be remembered that, as Mr. Baumann stated, the output of turbines was approximately inversely as the square of the revolutions. The disk and drum was useful, also in cases where a turbine had to be put into a restricted space, as sometimes happened in connection with the extension of old stations, but in cases where a new station was being laid out this did not come in, as the area taken by the turbines was a very small part of the whole station, which included boiler house, switchboard, &c. The disk and drum was also useful in small sizes, say, 500 kw. at 3,000 r.p.m., where there was a very high boiler pressure of 180 to 250 lb., in which case the pure Parsons turbine could not take the full benefit of the boiler pressure. Another point had to be considered, namely, the cutting of the impulse blades due to the high velocity of the steam. This was not so much the case if there was always high superheat, but with moderate superheat or with saturated steam it was very rapid. They had tested Curtis blading in a jet of saturated steam issuing at 150 lb. pressure, and exhausting into the atmosphere, and no material, even the hardest steel, would stand this jet without being cut for a space of only 45 hours. Several warships had been fitted with Curtis wheels, and in them it had been found that the cutting of blades had been very rapid. One battleship showed such bad cutting of the blades, even after it had only completed its trials, that it was estimated that the blades would require renewing by the time the vessel reached the other side of the world. They had never had any trouble with their labyrinth glands with pressures up to 20 or 30 lb. above atmosphere. Mr. Baumann said that for large outputs the Curtis and Rateau turbines were the better, because the disk and drum type would have to be made double-ended in the low-pressure part, which would considerably increase the cost of the turbine. This statement he could not agree to. For larger sizes they had adopted the tandem formation of turbine, which was first introduced for the 1,000-kw. turbines supplied to Elberfeld, in Germany, and recently they had made eight 6,000-kw. machines for the Lot's Road power station of the Underground Railways Co. of London to replace other turbines which were there: they had brought down the coal bill from somewhere about 3¼ lb. per kw.-hour to 2¼, and practically the cost of the change had been already saved. These turbines were of the pure Parsons type, and thus the efficiency that was obtained, even in the high-pressure part, was higher than could be obtained with a Curtis wheel. Dividing the turbine into two parts enabled the spindles to be kept very short; in fact, at Lot's Road the length between the shoulders of both the high-pressure and low-pressure spindles did not exceed 7 ft. Also in the small high-pressure cylinder the whole of the high temperature was dealt with, and thus distortion was minimised, besides which a steel centre could be used. Good blade height was obtained, and therefore the leakage was small. In larger sizes there was no difficulty at all about double ending, and they had not found that it appreciably increased the cost. They did not think it advisable to go above moderate speeds for the low-pressure blades on account of the large terminal loss, as pointed out by Mr. Baumann, but in certain cases, where it was desired to go to higher speeds, they had adopted a disk form of spindle, which they had used for blowers for many years, and with which there was no difficulty in going to the same speeds as with the wheels of a Rateau turbine. Such a combination for large sizes of a small Parsons high-pressure turbine in tandem with a low-pressure one, single or double-ended, exceeded the efficiency of any combination with a Curtis wheel. In every case during the last year they had got their guaranteed consumptions on test, except in one case of a disk and drum machine. Mr. Baumann further said that he did not consider caulked-in blades to be safe for high stresses. They had never yet had a case of blades coming out due to centrifugal force, except in one or two cases which were clearly traced to bad workmanship. In tests made on their blades, it was quite common for the blade to break off rather than pull out. From what he had said, it would be seen that the maximum output of the Parsons turbine was the same as that obtainable from the disk turbine, and the diagram of fig. 2, which was a most interesting way of putting the question, practically agreed with their figures, and was equally applicable either to the drum or to the disk type of turbine. He was much interested in the statement that it had been found necessary to keep the Rateau turbine below the first critical speed. In the past, there had been great trouble with the diaphragms of the Rateau turbine where clearances had to be very fine. It was necessary in any type of compound turbine to have fine clearances at some point between one stage and the next. In the Rateau and Curtis turbines this was in the glands of the diaphragms, and in the Parsons it was between the blades and the casing or rotor. Each party, of course, claimed that his way was the best, but looking at it broadly, there was not much to choose between the two. What Mr. Baumann said about there being liability to trouble with three-bearing turbines and alternators where they were rigidly coupled together was very interesting in view of the great trouble there had been in some large turbines in the North of England that were made thus. With reference to low-pressure turbines, Mr. Baumann said that the great importance of these was pointed out by Prof. Rateau, who first installed them in 1903. Sir Charles Parsons's patent in 1894 had been, until it expired, the master patent, and the torpedo boat destroyer *Velox* was made in 1902, in which, for cruising purposes, there were reciprocating engines exhausting into the turbines. He was glad to see that the list of consumptions was headed with 68·4 per cent. efficiency in the Richardsons, Westgarth-Parsons turbine at Dunston, which was of the pure Parsons tandem type, as described above. The tables of corrections for superheat and vacuum practically agreed with their figures. He could not agree with Mr. Baumann where he stated that the Parsons turbine could not utilise very high superheat, the figures he gave being exactly in accordance with their practice. Also, he said, that the drum turbine could not be designed for as high a vacuum as the disk turbine; he (the speaker) had already shown the fallacy of this statement; the overall efficiency of a properly designed Parsons turbine was as good for 29 in. as 27 in. vacuum, and this was exemplified in the tests of the above Richardsons, Westgarth-Parsons turbine, which had a vacuum of 29·1 in., barometer 30 in., or only 0·45 lb. absolute. Mr. Baumann did not touch on the most recent adaptation of the turbine to driving low-speed machinery by the use of helical gearing. The Westinghouse Co. in America had already utilised it for driving dynamos, and Messrs. Parsons were doing the same. They had working also a rolling mill running at 70 r.p.m., driven by a 750-h.p. turbine at 2,000 r.p.m., and in marine turbine work gearing was being extensively adopted. The experimental cargo boat *Vespasian* was giving 15 to 18 per cent. better consumption than could be obtained with reciprocating engines, and two destroyers and two cross-channel boats were also being fitted with geared turbines.

Mr. F. Samuelson said he found no mention in the paper of a Curtis turbine having been built in this country, although no fewer than 138 machines of this type had been built in sizes ranging up to 5,000 kw. It appeared that the impulse type of turbine was getting more and more popular, and the Curtis principle was gaining favour through its excellent qualities and great simplicity. The author gave curves of calculated efficiencies of Rateau and Curtis wheels with one, two and three rows of buckets. If the efficiencies given corresponded with actual efficiencies as determined by numerous tests, the single-wheel construction would be so far superior, that any other type would not exist. That this was not the case was clear from the table given where a large number of machines were compared, and taking the 3,000-kw. 1,500 r.p.m. turbine for comparison, he found that the Curtis turbine showed the highest efficiency. Curves were given of the tangential and radial stresses in turbine wheels, but no mention was made of the expansion of the wheel bore due to these stresses, and the formula given by the author did not enable one to get at these expansions. The author stated that nozzle governing complicated the governor gear to an extent not justified by the increased efficiency gained thereby. The speaker pointed out that all Curtis turbines built in Rugby were nozzle-governed, and that the governing gear was noted for its simplicity and its certainty of action. By means of nozzle governing an improved efficiency of 2 per cent. was obtained at three-quarter load, and 4 to 5 per cent. at half-load. These amounts represented quite a big saving in the coal bill in the course of a year. The value of mixed-pressure turbines was daily getting more understood and appreciated, as pointed out by the author. Most of these mixed-pressure turbines were operated in conjunction with some type of heat accumulator, and he drew attention to a most important feature—viz., the utilisation of the exhaust steam available under all conditions. The low-pressure end of the turbine being connected to an accumulator, the maximum pressure

was fixed at which the accumulator could regenerate the steam. Taking the case of a 1,000-KW. mixed-pressure turbine such as was illustrated in the paper, and assuming that the accumulator would generate at a maximum pressure of 16 lb. absolute, and that the machine required 33 lb. of steam per KW.-hour, the maximum total amount of steam passing through the low-pressure part would be 33,000 lb. of steam per hour, and the nozzles in front of the turbine were designed to deal with the full load at a maximum pressure of 16 lb. If an overload was demanded of the machine while 33,000 lb. of exhaust steam was available and they assumed the overload to be 25 per cent., it would be impossible for the steam going from the high-pressure portion of the turbine to find its way through the low-pressure wheel and at the same time admit the full quantity of 33,000 lb. of low-pressure steam. It might be therefore assumed that the steam consumption on the high-pressure part of the turbine, working, say, between 165 and 16 lb. absolute, would be about 40 lb. per KW.-hour. The low-pressure nozzles were already dealing with the maximum steam, and any further steam coming from the high-pressure wheel would find its way out of the system through the relief valve in the low-pressure pipe system, or, in other words, the accumulator would not be able to supply its available quantity of steam. 250 KW. overload at 40 lb. per KW. represented 10,000 lb. of steam, so that, instead of being able to discharge at the rate of 33,000 lb. per hour, the accumulator could only discharge at 23,000 lb. per hour, the available surplus of 10,000 lb. being blown to atmosphere from the relief valve. To overcome this difficulty, the B.T.-H. Co. had designed a mixed-pressure turbine wherein this objectionable feature was absent. With regard to the efficiency of the B.W. Co.'s mixed-pressure turbine, given as 69·8 per cent., he noticed this had been obtained with the assistance of 128° superheat. The author had dealt with corrections of superheat, &c., in the paper, and said that 4·25 per cent. better efficiency was obtained with 100° F. superheat. Referring, therefore, to tests given therein for a B.T.-H. 1,250-KW. mixed-pressure turbine, the efficiency on low-pressure steam was given as 68·2 per cent. with 24° F. Assuming that this B.T.-H. turbine had been running with 128° F. superheat, and applying the author's corrections, the efficiency would increase from 68·2 per cent. to 71 per cent.

MR. R. T. KAULA agreed with the author that for small and moderate size turbines the disk and drum type was the best design assuming the drum to be bladed on the reaction principle, but he would like to go further and say that the same held good for the larger outputs. The author's arguments against this statement were based on two main facts, viz., that the output for a given speed was limited by the heavy losses, and consequently by the diameter of the disk or drum at the low-pressure end, and, secondly, that a drum could not be run at so high a peripheral speed as a disk. As regarded the first assumption some allowance must be made for skin frictional losses, which varied approximately as the fifth power of the diameter with a disk, and about as the fourth power with a drum. There was an advantage here in favour of drum construction. The author had said that a disk without a hole in the centre could be stressed higher than one with, and he (the speaker) considered that a solid drum should be treated as the former. The well-known Willans system of blading lent itself to high-speed working, and he found that they were able to keep ahead of generator makers on the output speed curve without sacrificing economy and without adopting double-flow designs. One of the tables gave efficiencies which had been obtained on Curtis-Rateau turbines, presumably under favourable conditions, and showed a maximum efficiency of 67·9 per cent. for that design. He took it, therefore, that this was as good a figure as might be expected from this type of turbine, unless the output was increased or the steam conditions more favourable. With very few exceptions test results did not take into account the water contained in the air discharged from the condenser. The amount of water in question was approximately equal to that contained in saturated air, or at the temperature and pressure at which the air was separated from the body of water condensation.

MR. S. J. WATSON said that from what they had heard, each particular type had its advantages and its disadvantages. As far as one was able to judge, there was practically no difference at all either in their steam consumptions or in their efficiencies. In the past it had not always been possible to get the exact conditions under which test figures had been got, and the best and most important part of the paper, he considered, was that portion where the author gave the percentages of adjustments which were necessary for the vacuum and superheat of each engine. That would be found most useful to them. With regard to the regulating of nozzles, to his mind that was a question of some importance. The undertaking would have to run their machinery, at any rate, some portion of the day very much under full load. In these days of keen competition, anything that would enable them to save 3 per cent. to 5 per cent. was of no little importance.

DR. E. ROSENBERG said that in the paper it was mentioned that with exhaust turbines, for starting and paralleling, high-pressure steam was generally required, which was regulated either by hand or by a mechanical governor. He would mention an interesting installation where the necessity of high-pressure starting had been avoided by a novel electrical arrangement. When the Birmingham Corporation considered installing exhaust turbo-generators in their Summer Lane station, it was intended to use induction generators with squirrel-cage rotors which should work in parallel with the engine-driven alternators, being brought up to speed together with the alternators, no high-tension switch being provided for the turbo-generators. Going closer into this very ingenious scheme, he found that the wattless current of the additional load and also the magnetising current of the induction generator, would overload the engine-driven generators with wattless current to such an extent that this installation would have been only possible on a few of the sets, if all the other existing generators could be used to help out with wattless current, but that it could not be used as a general proposition. They obtained, however, the desired result by supplying synchronous turbo-generators with exciters direct-coupled to them and connecting the exciter field in parallel with the field of the main generator. The rotor of the turbo-generator was also fitted with a damper. Before starting, the field of the main generator was excited. In running up to speed, the turbo-rotor could never have a speed much different from the speed corresponding to that of the main generator, because the damper acted as a squirrel cage, and if the exhaust steam did not give sufficient power in the turbine, the damper would cause the turbo-generator to run as an induction motor, or if the power from the exhaust steam in the turbine was more than that required for the no-load losses (and that, of course, would be the rule), the damper would cause the machine to act as an induction generator, giving at slight over-synchronous speed, some power back to the main generator, so helping to drive it. But already at comparatively low speed the direct-coupled exciter gave sufficient E.M.F. to pull the turbo-generator into exact synchronism, and it would remain in synchronism. This patented arrangement not only simplified the starting as far as the steam end was concerned, but also simplified considerably the switchgear, as no switches were provided on the high-tension side. As far as the exciter field of the turbo-generator was concerned, there was only an adjusting rheostat, which could be set once for all. It was necessary in this case to use a direct-coupled exciter because the exciting voltage of the main generator (440 volts) was not suitable for a turbo-generator. All the main generators of the station were supplied from common D.C. exciter mains, the exciter generators being regulated by means of a Tirrill regulator. These D.C. generators were practically loaded to their utmost of capacity. Two of these exhaust turbo-generators (Belliss & Morcom turbines with Westinghouse generators) were in service and three others were being installed.

MR. P. A. SAUNDERS considered that as the previous speakers said that the author's figures almost entirely agreed with their own, they could be taken as a standard to work upon. He did not altogether agree with the author's remarks concerning disk and drum construction. It was much harder to detect lack of homogeneity in drums than in disks. With regard to the critical speed of shafts, he thought an equally important critical speed was that of disks owing to the effect the steam might have on them whilst running due to the openings in the preceding nozzles or diaphragm. The results of the turbines supplied to Chelsea were splendid, but it would be seen from the table given in the paper that there were many firms to-day who were building turbines quite equal to these machines. He thought that the present position of turbine efficiency was largely due to improvements in the design of condensers. Reference had been made to the cutting of blades by the velocity of the steam in turbines of the compound pure impulse type. He had seen many turbines of this type opened up recently, and after many months of service not one of them showed any signs of cutting due to this cause.

MR. A. E. MCKENZIE said it must be admitted that the Curtis-Rateau or the Curtis-Parsons type ought to be made cheaper than the impulse type, but makers of plain impulse type had been able to hold their own with the makers of the Curtis turbines. He thought a little higher efficiency could be obtained with the plain impulse type, and the efficiency could be maintained longer than with the other types. Up to now no blade erosion had taken place in the turbines of which he had charge. From the central station engineers' point of view, it was not a question of ½ per cent. or even 1 per cent. increased efficiency; the point they had to consider was the reliability of the machine. It paid them to run a turbine right through from one week-end to the other, and use a reciprocating set for the peaks. He did not see eye to eye with Mr. Saunders when he said that the regulation should be altogether automatic. They had to deal in Manchester with heavy peak loads, but they could afford time for a man to go and open a stop valve. He had no doubt that most engineers were very glad to hear that the stripping of reaction turbine blades had been absolutely stopped; he, however, knew one station engineer on the Continent who had had three 5,000-KW. sets down by stripping. With regard to the high temperature in the Zoelly type, the plain impulse type, such as they had, was suitable to withstand that temperature. One had been running for two years with a superheat temperature of 600° F. In the last set which was installed at Stuart Street they had a De Laval turbine of 450 KW., at 500 R.P.M., for driving the circulating water. This was supposed to be the first built in this country. It had now been running for two months, and they had not had any trouble. In the Zoelly type in this country it had been usual to use nickel-steel blades. On the Continent they were going in for a brass alloy, and where a nickel blade was adopted they were now adopting a bigger percentage of nickel, as high as 25 per cent., whereas it was usual to use 5 per cent. With regard to the tests given in the paper, the most important test on the Zoelly type was remarkable by its absence. It was quite equal to, and in some cases better than, those in the paper.

MR. R. LIVINGSTONE (communicated) said that when his firm, Messrs. Dick, Kerr & Co., took up the manufacture of steam turbines they fully realised that the turbine of the future would be one in which large clearances were obtained, and low temperatures in the cylinder, provided these points were not off-set by poor steam consumptions. The type adopted was an impulse turbine, with a high velocity first wheel, and the efficiency of this type of turbine was quite comparable with that of any other make. Although the writer agreed that the Curtis-Rateau was a better type of turbine for large outputs than the Curtis-Parsons type, he considered that the author in his calculations had accentuated the difference too much. In comparing the stresses in disks with the

stresses in rings he had considered only simple disks and simple rings. In actual practice, the periphery of a disk was usually cut away to some extent to form fastenings for the blades, and this very considerably altered the stress at the periphery of the wheel, and in some cases these stresses became of greater importance than the stresses in a simple disk, so that in comparing the permissible peripheral velocities one must always take account of the detailed stresses in the disk and in the ring. Again, in comparing the permissible length of blades only the effect of centrifugal force had been taken into account, but in the longer blades which could be used in disk turbines, owing to the larger diameter of disk, the bending stress due to the force of the steam became appreciable, and this also tended to modify the comparison of output between the disk and drum turbine. The influence of these factors was not great, but it was only fair to the drum type of turbine to take them into consideration. With regard to the critical speed of turbine rotors, Prof. Reynolds deserved the credit for the theoretical investigation of this important subject, and a very thorough investigation of the critical speed of shafts with different methods of loading was made by Stanley Dunkerley in 1893. The corrections given by the author would render comparisons of the steam consumptions of the different types of steam turbines more real than they had been. Very often when a low steam consumption was obtained on test, the turbine maker claimed all the credit, whereas the whole of the credit was often due to the boiler and condenser makers.

## The Degradation of Accumulative Energy.

By A. G. Collis, A.M.I.E.E.

(*Abstract of paper read before the* South Wales Institute of Engineers *at Cardiff, February 15th*, 1912.

Last year the author read a paper before the Institute on "Breaking High and Low Potential Circuits,"* of which the present paper is a sequel. A description is given of improvements in the design of switchgear for the relief of abnormal forces attending rupture, referred to in the title. Quick-break action may give rise to an abnormal potential stress. The rapid opening of a switch in a London supply company's undertaking, on a 6,000-volt circuit, gave a potential rise of 32,000 volts, which arced over the insulators and shorted the system, practically blowing the switch to pieces. Internal reactances limit an instantaneous short-circuit current, at the expense of regulation, but if the generator breaks down, the short-circuit current which can flow into it is only limited by the internal reactances of the other generators operating in parallel with it. External reactance also limits the maximum instantaneous value of a short-circuit current, but the potential builds up across the reactance on short-circuit, and, when interrupted, appears across the switch break, with energy more persistent than if the generator is shorted direct; and it lowers the power factor of the circuit, so that, if the circuit is being opened when the electric magnetic energy is a minimum, the potential is a maximum and punctures the insulation. Time-limit devices, to delay the opening of the switch until after the short-circuit current has reached a maximum, are unsatisfactory.

The "degradation of energy" (the reduction of energy which cannot be utilised) is the title applied by the author to his method of relieving or preventing the development of dangerous forces on the rupture of a short-circuit, without any disturbance of the continuity of supply, or modifying the power factor. He claims that he has succeeded in designing a switch which meets the problem, as shown by oscillograms.

The chief feature of the apparatus is the dielectric, which can be graded so as to prevent any predetermined rise of current. Its ingredients are chemical, together with oil, and it is practically uninflammable. The arc on rupture does not vaporise it; its specific gravity is 0·79, and its viscosity apparently does not change under 230° F. Its viscosity at 60° F. is 17, and allows of the free convection of heat.

It does not thin down during increase of temperature, and is free from resinoid and carbonaceous matter. No sedimentation appeared after use. It breaks down at 7,000 volts between needles ¼ in. apart immersed in it (see fig. 1). The new dielectric is only suitable for alternating current.

In addition to the current and pressure rating of an oil switch, its kilowatt capacity should be known; this depends on the power factor and the position of the wave on opening. An oil switch may open satisfactorily a 10,000-kw. load at unity p.f. which on a smaller load, at a p.f. smaller than unity, will entirely fail to interrupt the circuit successfully, due to the presence of a potential to restore the circuit when the current is zero. Moreover, conditions may be present which are not known to the maker or user, such as higher harmonics, approach to resonance, and inductance in the system, which all play their part.

For circuits of extra-high pressure, the author uses, as far as possible, switches with multiple horizontal breaks, which open the circuit effectively without being of abnormal size, and are cheaper in construction than the vertical-break type. He suggests that the reason is that the heavy head of oil, which is not disturbed as in the vertical break, damps out the arc more quickly, with less vaporisation.

Pressures of 60 lb. per sq. in. have been recorded in the oil on the rupture of a short-circuit on a 12,000-kw., 9,000-volt, 25-cycle turbo-generator, and other tests on voltages of 500, 2,000 and 5,000 a.c., with currents ranging from 700 to 2,200 amperes, showed oil pressures varying from 40 to 49 lb. per sq. in., the higher values occurring with the lower voltages.

The author made tests on a power station of 20,000 kw., 25 cycles at 5,000 volts; an oil switch was used to place the total supply on a dead short across phases, with a limiting resistance in circuit of a capacity of 10,000 kw. Between the supply station and the limiting resistance there was a three-core cable of 0·15 sq. in. section, 1,000 yards long, having an impedance of 2·4 ohms. The system was entirely insulated. In the a.c. test previously published one side of the system was earthed, and the middle point of the star assumed to be at zero potential, and the phases balanced. The potential coil of the oscillograph in this instance was connected across the phases and tested across either phase, in order to see if there appeared any variation in rises. In the previous tests

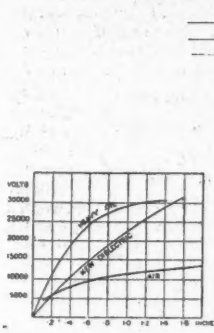



Fig. 1.

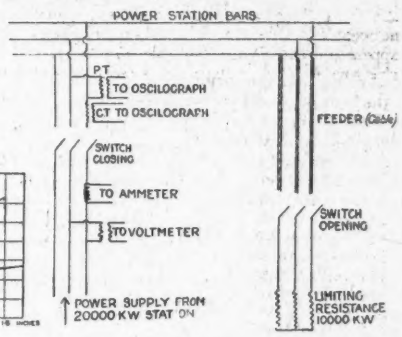



Fig. 2.

Fig 1.—Comparative Tests of a.c. Breakdown Pressure.
Fig. 2.—Diagram of Connections for Tests.

the potential coil of the oscillograph was connected across the switch. Thus when the switch opened, as one side was earthed, the potential coil of the oscillograph responded between phase and earth. In these tests the potential coil of the oscillograph operated in the secondary side of a potential transformer having a ratio of 5,000 : 100 volts connected between phases. The current coil of the oscillograph was actuated by the secondary currents of a s.p. current transformer, ratio 30 : 1, having a normal secondary current of 3·5 amperes and a maximum current of 5 amperes.

Fig. 2 shows the connections adopted; there are two switches in series, one of which, when closed, causes the other to open automatically under short-circuit conditions between phases.

Fig. 3.

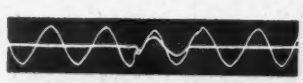


Fig. 4.

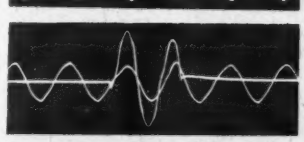


Fig. 5.

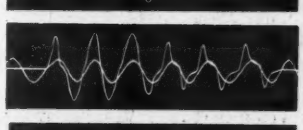
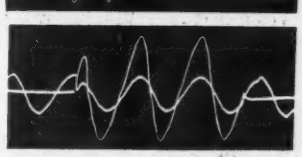


Fig. 6.



Opening 10,000-kw. Short at 5,500 Volts.

Fig. 7.

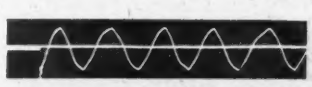


Fig. 8.

Fig. 7.—Closing, and Fig. 8 Opening, an Unloaded 5-mile Feeder.

The effect of opening a limited short of 10,000 kw. with the new dielectric is shown in fig. 3. The circuit was completely opened in $\frac{1}{75}$ second, the potential at that instant being about 50 per cent. of the normal circuit pressure (5,000 volts). The current was 720 amperes; the short-circuit current in the subsequent tests approached 2,000 amperes. The power factor was practically unity. The rate of current rise was 90,000 amperes per second. Repeating the test with a standard oil switch with vertical movement, opening automatically by gravity, assisted by springs under tension

* Electrical Review, March 3rd, 1911.

—the switch which appeared to give the most favourable results in comparison with other oil switches—the time occupied in opening was 1¼ periods, or 50 per cent. longer than with the new dielectric, with a current rise of 2,040 amperes on the first wave, 1,800 amperes on the last half period. The rate of current rise was about 250,000 amperes per second (fig. 4).

Fig. 5 shows the effect of opening a 10,000-KW. short with a time-limit switch, which delayed the opening of the circuit until 2½ periods had elapsed, the whole process to complete rupture covering six waves. The current rise on the first wave was 2,040 amperes, and on the last wave 1,200 amperes. The rate of rise of current was 250,000 amperes per second.

In Fig. 6 the circuit was broken by a switch opening with a velocity of 70 in. per second, and current began to flow at the peak of the voltage wave. The circuit was opened in 2½ periods. It is noticeable in this test, as in others, that the current at final rupture appears on the other side of the zero position. The rate of current rise was 300,000 amperes per second, and the second wave reached 1,920 amperes. The switch was fully opened before the circuit was entirely disconnected.

Fig. 7 illustrates the effect of closing an unloaded feeder 5 miles long, consisting of a three-core, 0·15 sq. in. cable, having an impedance of 0·69 ohm per phase. The oscillograms were taken at the extreme end of the feeder. The pressure rise in this case was 14,000 volts, which quickly fell to the normal (instantaneous) value of 8,000 volts. In another test the pressure rose to 16,000 volts.

The same feeder was opened on no load, with the result shown in fig. 8. A pressure of 3,000 volts remained on the circuit ¼ second after the circuit was opened, finally reaching zero in ¼ second.

Tests were also made on opening and closing D.C. circuits. On breaking an inductive load of 5,600 amperes at 500 volts, by opening a switch connected across the terminals of the circuit-breaker under test, the pressure rose 573 volts (total 1,073 volts) and the circuit was interrupted in 0·12 second (fig. 9). The breaker was of the magnetic blow-out type.

FIG. 9.—MAGNETIC BLOW-OUT CIRCUIT-BREAKER OPENING 5,600 AMPERES D.C. AT 500 VOLTS.

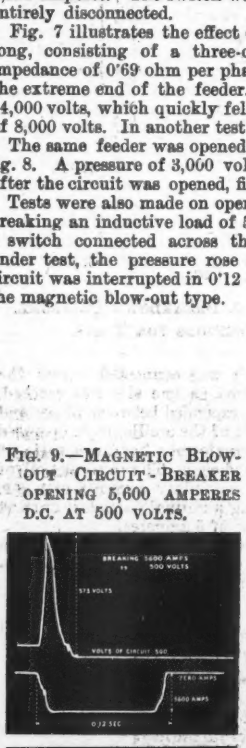



FIG. 10.—OIL-SWITCH OPENING 5,500 AMPERES D.C. AT 500 VOLTS.

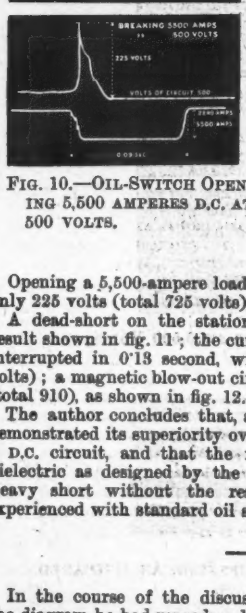



FIG. 11.—OPENING D.C. DEAD-SHORT WITH OIL SWITCH.

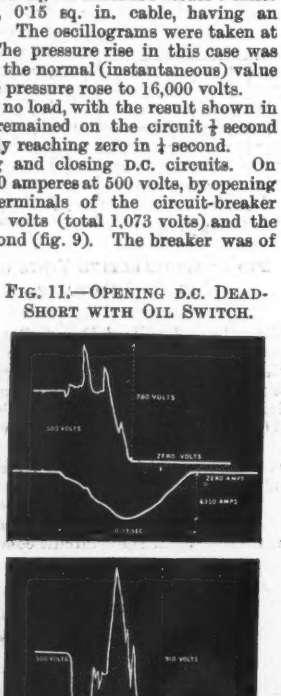
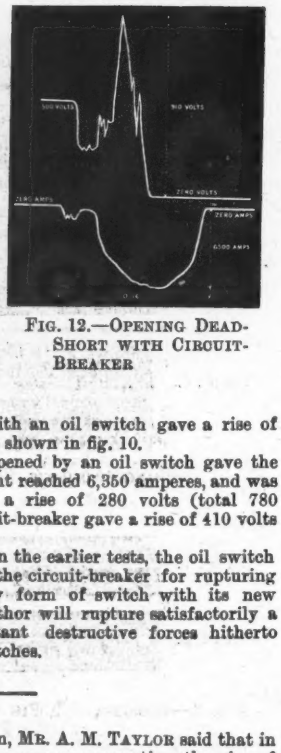



FIG. 12.—OPENING DEAD-SHORT WITH CIRCUIT-BREAKER




Opening a 5,500-ampere load with an oil switch gave a rise of only 225 volts (total 725 volts), as shown in fig. 10.

A dead-short on the station opened by an oil switch gave the result shown in fig. 11; the current reached 6,350 amperes, and was interrupted in 0·13 second, with a rise of 280 volts (total 780 volts); a magnetic blow-out circuit-breaker gave a rise of 410 volts (total 910), as shown in fig. 12.

The author concludes that, as in the earlier tests, the oil switch demonstrated its superiority over the circuit-breaker for rupturing a D.C. circuit, and that the new form of switch with its new dielectric as designed by the author will rupture satisfactorily a heavy short without the resultant destructive forces hitherto experienced with standard oil switches.

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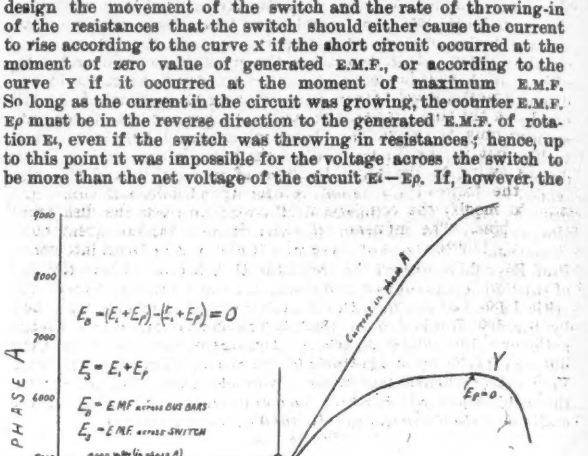
In the course of the discussion, MR. A. M. TAYLOR said that in the diagram he had reproduced the curve representing the rise of current in a short-circuited phase of a 5,000-KW. alternator, as given by Mr. Miles Walker in his paper read before the Institution of Electrical Engineers some two years ago. Since the current in the short circuit was a rising current, the reactance E.M.F. $E_P$ would be counter to the induced E.M.F. $E_1$, and this would be the case until the crest of the current wave was reached, when this E.M.F. ($E_P$) would pass through a zero value. Let them consider now what happened when the switch (with resistance steps) was opened. This caused the rate of growth of current to be checked in the manner shown by the curve X, or if the short-circuit occurred at the instant of the crest of the E.M.F. wave the checking of the current rise would be indicated by the curve Y. In the switch which he had designed it would be perfectly feasible so to design the movement of the switch and the rate of throwing-in of the resistances that the switch should either cause the current to rise according to the curve X if the short circuit occurred at the moment of zero value of generated E.M.F., or according to the curve Y if it occurred at the moment of maximum E.M.F. So long as the current in the circuit was growing, the counter E.M.F. $E_P$ must be in the reverse direction to the generated E.M.F. of rotation $E_1$, even if the switch was throwing in resistances; hence, up to this point it was impossible for the voltage across the switch to be more than the net voltage of the circuit $E_1 - E_P$. If, however, the




switch were so designed as to cause a very sharp fall-off of the current, as indicated by the curve Z, the reactive E.M.F. $E_P^1$ would have to be added to the generated E.M.F. $E_1$, and the sum of these two might be many times the E.M.F. of the generator, as would be the case if the curve took the form shown, and they would manifest themselves across the switch. This would account for the effect mentioned by the author as having occurred in a London station when a rise of 32,000 volts was observed on a 6,000-volt circuit. Provided, however, that the downward slope of the curve X was never at any moment greater than the upward slope of the short-circuit current of the machine, it was impossible for the reactive E.M.F. $E_P^1$ to exceed the rated E.M.F. of the machine; and if the curve was made to droop at or near the point shown on the curves X and Y, when the generated E.M.F. $E_1$ was passing through, or was in the neighbourhood of, zero; the rise of E.M.F. across the switch could not be appreciably more than, and could, if desired, be made only a fraction of, the normal E.M.F. The author rather conveyed the idea that 20,000 KW. of machinery was running during the tests, but really only some 6,000 KW. was running. The limiting resistance was so high that the conditions were comparatively not at all severe, and were only designed with a view to test certain oil switches of the ordinary type prior to their acceptance. Since the switch with the new dielectric was not tested at these tests (at which the speaker was present) care should be exercised in making any comparison. The velocity of 70 in. per second given was only a calculated velocity after 1 in. travel of the switch (at which point the main contacts opened), and neglected the damping effects of friction and of the displacement of the oil. Probably the actual velocity was considerably less. Had the switch been put on to a really serious "short" there would have been a tremendous development of energy, and the switch would probably have been blown to pieces. It was worth noting that all these oscillograms differed fundamentally from those obtained by Mr. Miles Walker under conditions of a "dead short"; in fact, the periodicity of his oscillations was approaching the double of the normal frequency, as would be expected from theory, whereas in Mr. Collis's tests they were exactly of the normal frequency. This was because in Mr. Collis's tests what was virtually a pure resistance was employed for the limiting resistance, whilst in Mr. Walker's tests it was virtually a pure self-induction. The latter condition provided a much more serious test of the switch, unless the break occurred at the crest of the E.M.F. wave, which was unusual.

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## Notes on Central-Station Practice.

A PAPER was read by MR. A. NEAVE KINGSBURY before the Students' Section of the INSTITUTION OF ELECTRICAL ENGINEERS on January 17th last, from which the following extracts have been made:—The immense scope of the subject naturally only allows of comparatively superficial treatment, and emphasis is therefore laid in this paper on those points in station design and management

which are seldom raised in text-books, or even in the technical Press.

In connection with boiler and power-house details, particular stress is laid on the steam-piping system, for which natural drainage is advocated as a means of reducing the number of steam traps, with their attendant losses, to a minimum. Incidentally, it is pointed out that the adoption of graphite as a steam cylinder lubricant may effect a reduction of from 50 to 80 per cent. in the bill for cylinder oil.

Passing to the section on the electrical equipment, comment is made on the satisfactory working of commutators with air instead of mica insulation between the segments.

The advantages gained by the continual check on the staff given by recording instruments are particularly emphasised in the case of large stations, in which the coal bill may amount to from 50 to 80 per cent. of the total running costs, and mention is made of the steam consumption indicator, which depends for its operation on the difference of pressures on the sides of a disk placed in the steam range.

Perhaps the best cure for carelessness on the part of the staff is the imposition of small fines, but under the Truck Acts it is illegal to deduct such fines from wages. To overcome this difficulty, and also to interest the whole staff in the efficient operation of the station, a coal bonus system is sometimes introduced, which, though really amounting to a small increase in wages, allows the imposition of fines. Such a bonus is based on the coal cost per unit, but as this is influenced by many outside factors, the actual coal cost figure, adopted as the basis of the bonus for any month, will depend on the station output and the price of coal during that month. This figure will also have to be decreased if plant improvements are carried out, involving an increased capital expenditure. In one generating station this has resulted in a reduction of the average bonus basis from ·306d. to ·180d. per KW.-hour during the last six years.

The amount paid to the coal bonus fund may be divided among the staff in the following proportions:—Shift engineers and chemist, 6¼ per cent. each; charge electricians, 2 per cent. each; leading firemen, 3¾ per cent. each; firemen, 3½ per cent. each; greasers and switchboard attendants, 2¼ per cent. each. Bonus working interests the men in their work, and good results have been obtained in almost every case where it has been adopted.

At the close of the paper reference is made to the recent correspondence in the electrical papers from disappointed central-station employés, who have taken up this work without realising its monotonous nature. The remedy suggested is that college men should spend at least one long vacation in a central station and thus obtain some idea of the routine before it is too late.

## LEGAL.

### Attorney-General *v.* Sheffield Corporation.

(*Concluded from page* 295.)

On February 21st further evidence was heard for the defence.

Mr. James Swinburne, further examined by Mr. Sargant, said that it was important that the wiring in the house should be efficiently done. The suppliers of energy had the right to refuse a supply unless the house wiring was up to a certain standard.

Do you consider there is any commercial advantage to the consumer in having the wires and fittings of the house supplied by the same persons who supply the mains and give the supply?—Yes, it is obviously to his advantage.

Do you agree with what was said yesterday that it is essential for the giving of a proper supply to have proper wiring in the house as well as proper wiring of mains?—Certainly.

Cross-examined by Mr. Lawrence: Do not the Board of Trade regulations contain a provision that the undertakers are not bound to supply electricity until they are reasonably satisfied that the consumer's apparatus and fittings are such as not to cause leaks, or in any way injure the undertakers?—Yes, that is so.

And for that purpose the inspectors of the undertakers make it a practice in every case, before connecting up their wires with the consumer's wires, to test his system?—Yes.

Mr. Samuel Edgar Fedden, electrical engineer to the Corporation of Sheffield, said he had been general manager and engineer to the electricity undertaking since 1900. Before that he held various appointments as electrical engineer to Corporations in the U.S.A., Canada, Edinburgh, Greenock and elsewhere, so that he had a very large experience in electrical undertakings.

When you took charge of this undertaking in June, 1900, was the annual turnover about £22,364?—Yes.

Was the amount for the year ending March 25th, 1910, £70,640, of which, roughly, £47,156 represented lighting and heating and £23,484 represented power?—Yes.

To what do you attribute that increase?—To our advertising by means of canvassing from the wiring and fitting department. Canvassers call upon prospective consumers and explain the benefits of the supply to them. They carry out any experiments that may be desired and generally assist people in learning what are the uses of electricity.

I believe you have devoted a great deal of thought to this matter, and are prepared to tell the Court that there are certain commercial advantages in the Corporation being at liberty to supply fittings and wire the consumers' houses.

Mr. Lawrence objected to the question.

Mr. Sargant asked his Lordship to take the evidence subject to the objection.

His Lordship said he did not think it was admissible, but he thought he had better admit it at present, subject to the objection.

Mr. Sargant: Now, Mr. Fedden, are there advantages when you are canvassing consumers in being able to tell them that you can supply the whole thing?—I think there are great advantages. In the first place, I think the consumer feels there is a sense of security in dealing with a Corporation. The Corporation in wiring a house will bear in mind that they are responsible to the consumer, and see that they do not put in too many lamps.

Assuming the inside wiring was done by an outside contractor, I suppose the servants of the Corporation department would have to go to the house for certain purposes?—Yes, they have to deal with all that part of the apparatus which belongs to them.

From the point of view of rapidity, do you think there is any advantage to the consumer?—Yes, because he has only to deal with one authority instead of two.

Have you known cases in which there has been delay through there being two sets of contractors?—Yes.

Is it ever necessary when you fix a motor to put an electric lamp in also?—Yes. The consumer nearly always asks to have an electric lamp fixed up in connection with the motor.

I want you to look at it from the undertaker's point of view supposing there is anything wrong. Supposing the consumer finds the light not working properly, to whom does he send?—He always sends down to us.

Mr. Lawrence: Is that whether you have wired the house or not?—I think so where anybody has done it.

Further examined, Witness said the books showed that for the year ending March 25th, 1910, there were 4,193 calls. He could not say in how many of those cases the consumer had the apparatus of another contractor.

Cross-examined by Mr. Lawrence: When you took over the management, was the wiring and fitting department conducted separately from the supply?—It was.

I understood you to say you were forced to open the arc lamp department. Do you mean it was done before you came on the scene at all?—I believe so, in February, 1900.

Where is this wiring and fitting business carried on?—At Commercial Street and at our repair shop in Suffolk Road.

Is the building in Commercial Street a separate building rented by you for the purpose of the wiring and fitting department?—No, the offices belong to the Corporation.

Witness added that they were general offices, and that the showrooms were open to anybody who chose to come in and buy. Lamps, fittings, &c., were purchased from the manufacturers and resold at a profit.

Is it a fact that the stock in trade in connection with this department on October 17th last was valued at £2,286?—That may be so.

Witness further admitted that the department supplied telephone instruments, lightning conductors, &c. He said the establishment in Suffolk Road was devoted entirely to repairs. He believed they had stopped doing repairs there for non-consumers.

Are you certain about that?—I believe I am correct. I do not absolutely know.

Do you do general engineering work there?—We do sundry repairs.

In your department have you started supplying vacuum cleaners for houses?—We have.

From your repair shop do you conduct the business of taking down and repairing shafting?—Yes.

Do you do electro-plating?—I think we send it out to be done.

Do you supply bells to people who are not using your electric light?—Yes, we have done.

It was suggested that you did that in the hope that some day they might use the light?—I think that refers to wiring.

You do supply bells and telephones to people who are not consumers of energy for lighting purposes?—Yes.

Re-examined: Witness said the vacuum cleaners and shafting he was asked about in cross-examination were all driven by electric power. The sales over the counter were very small compared with the customers whose names were booked.

Mr. James Wm. Wright, the City Treasurer of Sheffield, examined by Mr. Sargant, said he remembered the purchase of the electric light undertaking on December 31st, 1898. He was not treasurer then, but he was in the office. The amount handed over was £299,000, and was made up of £262,000 cash, £25,000 for debentures and £12,000 for bank balance.

It is said that the Corporation borrowed money to carry on the electric light undertaking and applied money from the borough fund?—That is not so.

In certain years were there losses. Out of what funds were they discharged?—Out of the accumulated profits of previous years' trading of the undertaking.

Have you prepared a table showing the capital expenditure on the electric light undertaking from 1898 onwards?—Yes. And with two exceptions the amount of the borrowing sanctioned has always exceeded the amount of the expenditure in each year.

Cross-examined by Mr. Lawrence: Do you suggest that this table shows whether you have used the ratepayers' money or not in carrying on this business. Do you think these figures will give us any idea whether the ratepayers' money has been used?—I say it has not been used.

His Lordship, to Witness: Do you say that the plaintiffs' charge of using the ratepayers' money is completely refuted by looking at those figures?—No, I can't say that.

Mr. Lawrence: Do you have any special arrangement with

your bankers that if one of your accounts is overdrawn they shall not set off one against another. You know bankers have the right to do that if there is no stipulation to the contrary?—We have no special arrangement with the bank.

WITNESS was cross-examined on certain of the Corporation accounts to see if there was any separate rental value assigned to the premises used for the electric light undertaking and the repair shop. He said he knew of no book which contained any such entry. He was not concerned with the items in the accounts. All he had to see was that the accounts were in proper form. They had a proper auditor to check the items.

Have you ever transferred any balance from the electric lighting account to any other department in relief of the rates?—No balances standing to the credit of the Corporation.

MR. LAWRENCE: When you get a sanction for a loan for the purpose of the electricity department, does it say how you are to raise it?—No. The only stipulation is that it shall be repaid in a given number of years.

WITNESS explained that in 1908 they divided their banking accounts among four banks instead of having one bank. The Sheffield Banking Co. only dealt with the electricity undertaking and the education accounts. The total authorised capital expenditure on the electricity undertaking up to the end of March, 1910, was about £998,000.

MR. J. W. BARNES, commercial manager of the defendants' electrical undertaking, said he was formerly in the service of the Sheffield Electric Co., taken over by the Corporation, and he had had 25 years' experience in electrical matters. He described the kind of business done by the company at the time it was taken over, which included all electrical work. The Universal Fittings Co.'s business was transferred to the Sheffield Co. in May, 1897, but that was before he joined the latter. On the transfer the Corporation necessarily employed the officers of the old company, and also acquired the stock-in-trade. Contracts were running when the company was taken over which had to be gone on with, including the Durn Valley Waterworks Co., which was for maintenance among other things. That contract was not renewed after it ran out. At the time of the transfer the Sheffield Co. did a good deal of manufacturing of fittings, electroliers, and also the fittings required for general lighting. That trade continued to exist right down to 1910, but the trade outside the city had been stopped, and now they did not make anything except for use on their own mains.

When did they cease supplying even to persons in the area?—We can hardly say we have ceased to do that yet.

What kind of goods are on view at the showrooms?—Electroliers, standard brackets, standard lamps, glassware and lamps, pendants for rooms of any kind, radiators, cooking utensils and apparatus, &c.

Is there anything in your showroom, or which you have in stock, which is not fit to be used in connection with electric supply?—No.

What is the nature of the wiring and fitting department as carried on by the Sheffield Corporation at the present time?—Wiring and fitting of houses, shops, theatres and manufactories in the town; and for electrical power and electrical heating. There were also a large number of contracts for the cleaning and upkeep of lamps, the supply of carbons, &c. At present there were about 400 lamps kept in order by the department. They also did installations of bells in places where they did the lighting. There were a few instances where they had done the bells, but did not supply the light, but that had not been done for some time.

WITNESS added that the wiring and fitting department had been a success as regards the amount of work done, and the result had been to largely extend the supply of electricity.

Do you do a certain amount of cash business across the counter?—Yes, but it is very small.

Are the gross cash sales made across the counter as follows:—1898, £53; 1899, £71; 1901, £94; 1902, £78; 1903, £66; 1904, £71; 1905, £99; 1906, £115; 1907, £161; 1908, £177; 1909, £223; 1910, £190, and 1911, £181?—Yes, that is correct.

Can you tell what proportion of the cash sales would be represented by the sale of lamps?—I think a large proportion—probably 80 per cent.

Further cross-examined, WITNESS said all he knew about the agreement with the Yorkshire Power Co. was that the Corporation were allowed to supply the Yorkshire Co.'s area. He knew nothing of the details of the agreement. Witness had nothing to do with the apportionment of the accounts in regard to the electric light undertaking. Mr. Whiteley, the chief accountant, would be able to give full particulars of all those matters.

Re-examined by MR. SARGANT: The Corporation had not done anything themselves in regard to retaining contracts. The last telephone installation they made was about eight or nine years ago.

MR. SARGANT said the chief accountant and Mr. Seabrook, electrical engineer, would be the only other witnesses. He thought the accounts spoke for themselves, but there seemed to be some sort of suggestion that there was a bogus portion charged for rent.

MR. LAWRENCE: No, but I can't find the rent charge.

HIS LORDSHIP: Then you had better call the accountant.

MR. JOHN FOSTER WHITELEY, chief accountant to the Electrical Supply Department of the Sheffield Corporation for four years, examined by MR. SARGANT, produced tables he had compiled of expenditure on the department down to date, which he handed to plaintiffs' counsel.

You know that a point has been raised as to the rent charged by the general undertaking on the wiring and fitting department; was it ever suggested to you that it would be advisable to diminish the rent payable by the wiring and fitting department, so as to make it show a profit?—Decidedly not.

What was the amount fixed for the occupation by the department of its floor?—I presume you are speaking of rent, rates and taxes?

Yes.—One-half.

In your opinion, is that a fair apportionment as regards that floor and the other part of the building?—It was at the time; it may not be now. I think it is too much at present.

WITNESS was cross-examined by MR. LAWRENCE as to an inquiry by a committee in regard to having depreciation and obsolescence reserves.

Was any portion of the amount recommended to be set aside apportioned to the wiring and fitting department?—To the best of my knowledge, no.

WITNESS explained that renewals were paid for out of the profits of the department. The whole building in Commercial Street was assessed at £200 for rating purposes.

The repair shop and factory was rated at £93 net. No interest on capital was debited to the wiring and fitting department in any of the accounts.

Re-examined, he said it was not necessary to write off depreciation. There was a fairly rapid turnover of the stock. It averaged about four months.

MR. ARTHUR H. SEABROOK said he was an electrical engineer, and since June, 1909, had been general manager and electrical engineer of the Borough of Marylebone. Before that he was with the West Ham Corporation.

MR. SARGANT: I am going to ask you some general questions as to the advantages of being able to do wiring and fitting work.

MR. LAWRENCE objected.

HIS LORDSHIP: It will all be subject to your objection. It is only to show how nice it would be to do the whole thing.

WITNESS gave figures showing that since the West Ham Corporation obtained powers to supply fittings there had been a great increase in the supply of energy. He attributed the increase to the facilities for trading. In 1909 the Marylebone Borough Council inaugurated a sales department under his supervision, as he had the experience of West Ham to guide him.

Speaking generally, did that result, to the best of your judgment, in an increased output?—Yes. Briefly speaking, the result was that until 1909 the output for lighting—it is mainly a lighting district—was almost stationary, and the net result was an increasing loss. After we started developing the sales department this result was totally reversed. The income from lighting went up considerably, and the loss was changed into a substantial surplus.

Speaking generally, you consider that the establishment of a wiring and fitting department added generally to the output and prosperity of the concern?—Yes. I think it is essential to compete with gas companies that we should have these powers and should exercise them. We cannot possibly develop our undertakings unless we have the same facilities as our competitors.

Further questioned, WITNESS admitted that there were disputes in Marylebone, and that some persons were contending that the department was not a success. He agreed that on the 1910 figures the sales department alone showed a loss of £1,100.

MR. DANCKWERTS put in evidence the charter of the Sheffield Corporation, dated 1843, and said that concluded defendants' case. He did not propose to address his Lordship at any length, because it was clear they were only there on the way to the higher Courts. His Lordship had intimated that he would follow Mr. Justice Neville's decision in the Leicester case, and while he (counsel) said that was wrong, he was bound in that Court to yield to its authority. That left open one or two other points. In the first place, he could quote authority that at common law a Corporation could do anything that a private individual could do.

HIS LORDSHIP: Do you mean whatever be its charter?

MR. DANCKWERTS: It can do anything not forbidden by its charter. He agreed that they could not use the rates which they had power to levy under the Municipal Corporation Act for any purpose not authorised by that Act. He said that whatever they could do by contract or otherwise it was perfectly lawful, and though they could not resort to the municipal rates, still the contract was perfectly valid and binding.

HIS LORDSHIP: Supposing a Corporation, not relying on their innate common law powers, go to Parliament and ask for specific powers and get them, can they afterwards be heard to say: We take the benefit of those specific powers, and in so far as we did not ask and get anything more, we shall exercise our common law right.

MR. DANCKWERTS said his Lordship was directing attention to the Provisional Order of 1892. He did not say that the Corporation could use anything which came into being under that Order, except as authorised by the Order; but that Order did not purport to cut down the pre-existing powers. Under the Order the Corporation could not use the undertaking authorised by that Order for supplying electricity outside the area, and therefore defendants did not claim that they were entitled to use any supply of electricity or to use the powers given by that Order for laying down mains outside the area.

HIS LORDSHIP said there was another point. Under their Act of 1903 the Corporation got power to sell and supply motors, but there was a restriction on them not to manufacture. Did that derogate from their pre-existing common law rights?

MR. DANCKWERTS said they did not claim to manufacture, and, therefore, it was not germane to this action. He submitted not, because the powers could co-exist. He did not think it would justify them in supplying energy outside the area because of the express prohibition. His learned friend, Mr. Sargant, was more familiar with the facts of the case, and would deal with them; but so far as he (Mr. Danckwerts) understood the evidence from 1902 onwards, the fittings departments always had a surplus. Therefore he did not think that Mr. Lawrence's cross-examination about

depreciation and sinking fund had anything to do with it. The only importance of it was to show that they had never resorted to the rates to defray the cost of the fittings department.

His Lordship said, although there might be a little in it, it was quite obvious that at times the expenditure on the electricity department altogether, including the motor department, was in excess of the moneys which were actually in hand, and the excess was temporarily met by an advance by the bank, which was, of course, charged with the benefit of a bankers' lien on the moneys standing to the credit of the borough generally.

Mr. Danckwerts said he did not agree. The bankers' lien would only extend to those funds which the Corporation could properly use to defray any particular debt of the bank; that was obvious. The bankers knew they were a Corporation and had limitations on their powers and knew where the funds came from, and therefore they would know they had not a lien on the funds. He said the Corporation never did, and did not intend to resort to the borough rate or any other rate for the purpose of defraying expenditure on the fittings department. That left him one alternative contention that he put forward now. They did not claim to supply fittings for electric lighting purposes for anything not connected with their supply, but apart from that he claimed common law powers.

His Lordship: Did that state of things exist in the Leicester case.

Mr. Danckwerts said he conducted the defence there, and he did not put forward common law rights at all there, so it was not covered by the decision of Mr. Justice Neville. As regarded the Sheffield Corporation Act of 1903, he put that forward as an alternative to the common law claim, and he claimed that that Act covered the whole bag of tricks. He thought he had covered the whole ground, and it was such a good argument he did not want to spoil it by amplifying it.

His Lordship: Do you rely on the fact that your authority was to purchase the undertaking of a commercial company, which was, as a matter of fact, carrying this on as part of their business?

Mr. Danckwerts said he did not want to do so unless he was driven to it. Under the Transfer Act, 1898, he maintained that not only were they entitled, but they were bound to carry out what the company had in hand in the shape of contracts and obligations, and further, they were bound to take their stock at a price. That stock formed the foundation of the fittings department.

Mr. Sargant said he did not know whether his Lordship wished to hear him at length on the facts.

His Lordship said, with all respect to counsel, a great many of them seemed to be irrelevant to the issues he had to decide. Some of them, however, might become relevant hereafter in certain events. If Mr. Justice Neville's decision was right, it was immaterial how they paid for the department.

Mr. Sargant said he would deal with the question whether or not there had been expenditure out of public money on the department. He submitted that plaintiffs had failed to make out their case. The evidence of the city treasurer was conclusive on that point. The Borough Fund, the District Fund and the Electric Department Fund were all kept perfectly separate.

His Lordship said there seemed to be two questions involved. First, whether, as regarded the electricity undertaking and the other Corporation undertakings, there was ever any borrowing from the the general funds in aid of the electrical undertaking, and then there was the subsidiary question whether as between the various departments of the electric undertaking the borrowing, if there was any, could be attributed to the one or the other. If it was conclusively proved there never was a deficit and never a loss on the wiring and fitting department, one might say that under no circumstances could a deficit on the general electric scheme be apportioned to that particular department, but had he any materials for forming any satisfactory opinion on the first question. It depended on a variety of things.

Mr. Sargant said he did not think his Lordship had.

His Lordship said as between the electricity undertaking and the fittings department, he did not know that a loss had been proved on the fittings department, but on the other hand, had defendants proved there was not? It really came to a question as between the electrical department and the other undertakings of the Corporation. Plaintiffs had not established that there was a loss on the fittings department, but had established that there was a loss on the whole undertaking in two of the earlier years. Did not that shift the onus on to the defendants to show that the loss was not attributable to the *ultra vires* part of the undertaking.

Mr. Sargant submitted not. The loss was only in two years, and since then there had been no loss on the whole undertaking. If the onus was on him, he submitted he had discharged it. It was clear that this fittings department was only a very small part of the whole electricity undertaking. The capital attributable to it was only some £20,000 of the whole capital of the undertaking which approached a million. At the time the undertaking suffered a loss, a great many other concerns suffered a loss through the introduction of the metallic-filament lamps. Taking the whole undertaking right through, there never was such a loss as to wipe out the accumulated surpluses. As regarded the main part of the plaintiffs' case that was admitted, and the Corporation claimed the right to do it. He agreed that where there was a mixed question of law and fact, his Lordship could not be asked to differ from Mr. Justice Neville.

Mr. Lawrence, in the course of his reply, said he desired to say something about the question that had been raised at the last moment without notice to the plaintiffs, and after all the evidence had been given, namely, as to the common law powers of the Corporation. The charter was not pleaded, and the point was not raised in the case before Mr. Justice Neville. It might be that such an argument could not be sustained if it was shown that the department had not been carried on at a profit and plaintiffs had had no discovery of the books on that ground. Then the defendants came and said that the onus was on the plaintiffs to prove that it was not carried on at a profit and claimed to succeed on that. He felt a little embarassed because this point had been sprung on him, but he contended it was immaterial because he had proved utilization of moneys raised by statutory authority in carrying on this illegal department. It was clear that the Corporation had been using money borrowed from the funds. They were occupying premises for the department, which had been acquired out of the moneys borrowed for the undertaking. They were utilising money provided for a specific purpose. They were not debiting anything to this department for the use of the capital or for the use of the premises. There was not a shadow of doubt that the department would show a loss if the Corporation was not behind it. If an ordinary trader had started it, he would have had to shut up within a year. That was the vice of all this municipal trading. They sent out accounts showing a nice profit to ratepayers, who were not able to understand them, and directly a competent person came to look into the accounts they showed a loss. On the figures alone, his Lordship had ample material, even taking the defendants' own modest estimate of a fixed working capital of £20,000 for holding that there was not a single year in which the defendants had shown a profit. If it was an ordinary trader the whole thing would be mere moonlight madness.

On Friday his Lordship gave judgment. He said the relator, a ratepayer in the city of Sheffield, alleged that the defendants, as the local authority for the purpose of the Electric Lighting Acts, 1882 and 1888, had acted, and were still acting, in excess of the powers possessed by them as such authority. He claimed declarations framed with a view to delimit those powers, and an injunction to restrain any further transgression of those limits. The subject matter of the relator's allegations fell under three heads—first, acts done within the area of supply; second, acts done outside that area; third, expenditure of the corporate funds and the use of the corporate property for the doing of such acts. The decision of the issues in the action turned largely on questions of law, which were not infrequently arising, and which affected many persons and bodies outside this litigation, and the parties had intimated their intention of carrying these proceedings to the House of Lords, with a view to obtaining, if possible, a final adjudication of the legal problems involved. The facts which he held to be established partly by oral and documentary evidence, and partly by admissions made before and during the hearing, were as follows. Within their area the defendants had done the following things:—(A) They had carried on, and still carried on, the trade of erecting and installing electric light fittings and wires and electric bell fittings and wires in houses and other buildings. It was not confined to work done for persons taking, or contemplating taking, a supply of electricity. They had also in similar circumstances supplied wires and other apparatus necessary for domestic or indoor telephones, and had supplied, and through sub-contractors, had installed lightning conductors. (B) They had opened, and were keeping open, a depôt for the supply and sale to the public at large of electric lamps, fittings of all descriptions, bells, batteries, accumulators, switches, switchboards, voltmeters, telephones, lightning conductors, cigar and cigarette lighters, and numerous other electric fitments and accessories. (C) They had executed repairs to such installations as were enumerated in paragraph A, and had entered into time contracts for the cleaning, maintenance and supervision of arc lamps in use upon premises to which they supplied electricity. (D) Outside their area they had sold and supplied motors, electric lamps and fittings, and a large number of separate parts and accessories for electric motors. (E) They had erected and installed electric light fittings and wires and electric bell fittings and wires in houses and premises not intended to be supplied by them with electricity. (F) They had executed repairs for persons and firms to whom they had supplied such motors and fittings, and for whom they had made such installations as were referred to in paragraphs D and E. The funds expended in carrying out these operations had been supplied out of moneys borrowed under statutory powers for the purpose of the defendants' electric undertaking, or raised on temporary loan from their bankers by way of overdraft, such overdrafts being repaid out of further moneys borrowed under statutory powers. The capital sunk or invested in the wiring and fitting department of the electrical undertaking, which was the department controlling and carrying out the foregoing operations, was a sum of between £20,000 and £30,000. It appeared from the accounts that the revenue of the department had uniformly exceeded the expenditure, but in arriving at this result no charge had ever been made against the department for interest on capital, or for rent of the Corporation premises occupied for the purposes of the department, nor had any allowance been made in the department accounts for depreciated or obsolete stock. So far as the work enumerated in paragraphs A and C of this judgment, was done for consumers of electricity supplied, or about to be supplied, by defendants, the facts were brought entirely within the recent judgment of Mr. Justice Neville in the case of the Attorney-General *v.* the Leicester Corporation, and, in accordance with the well-established practice, he must adopt and apply the law there applied to a precisely similar state of facts, unless there was any sufficient reason for his not doing so to be found in either of the two points raised on behalf of defendants. Mr. Justice Neville's judgment was not limited to the consideration of cases falling within paragraphs A and C of this judgment. The statement of claim in the Leicester case contained allegations of a course of dealing and conduct practically identical with that he had held to be established here, and which he had detailed in paragraphs B, D, E and F. He thought, therefore, subject to the same,

qualifications that the decision was equally applicable to the matters therein referred to. The two points urged on behalf of the defendants were these: In the first place, it was said that the defendants, being a Corporation incorporated by charter, had power to do anything not expressly prohibited by the charter, and that plaintiffs could not succeed here in their claim, because they had not established affirmatively any contravention by defendants of the provisions of the Municipal Corporation Act of 1882 in relation to the Corporation finances. In his opinion, it was not open to the defendants to raise this defence. It was never suggested until their case was being summed up, and the numerous interlocutory applications, including several stoutly-resisted applications for discovery and inspection of documents, books and accounts of the defendants, had throughout been framed and proceeded on the footing that defendants had been relying solely on their statutory and not on common law powers. But even if the defence was capable of being raised, he did not think there was any substance in it. It was impossible to take any one of the impugned Acts and and dissect it and pronounce that one part of it was *intra vires* and the remainder *ultra vires*. One must look at the transaction as a whole, and the fact, if it be a fact, that the defendants had power to do part of an Act would not legalise the Act if its completion involved at any stage a slip *ultra vires* of the Corporation. In the circumstances here existing, every Act involved the application and user of money raisable for one set of purposes only to and for other and alien purposes, and, in his opinion, it was no answer to a claim to restrain repetitions of such acts to urge that a part at any rate of each transaction was *intra vires* of the Corporation. The second point taken on behalf of the defendants involved the construction of the Sheffield Corporation Act, 1903, and in particular Part IV. What were the further powers conferred by Sec. 18 upon the defendants in reference to their electric undertaking, and were such further powers exercisable outside the limits of supply? The answer to the second part of that question must, in his opinion, be in the negative. He could see no ground found in the section itself that was incompatible with any other answer, and in like manner the powers were themselves restricted. They did not extend so as to include electric motors and apparatus used for all purposes, but only electric motors and apparatus used for the specific purposes, and when the section spoke of an electric motor and apparatus used for motive-power it referred only, in his opinion, to that which was the source of the power, not necessarily even to the mechanism, shafting, or what not which transmitted the power, and certainly not to the objects to which the power was transmitted—such as the machines, lathes, or tools or bells, as had been there suggested. On all grounds, therefore, he thought the case was covered by the decision of Mr. Justice Neville, and he must make a declaration that the defendants had no power to carry on the trade or business mentioned in paragraphs 10 and 11 of the statement of claim, or the trade or business of repairing or keeping in repair installations of electric light fittings and wires in houses or other buildings, or of electric bells, fittings and wires, or any such businesses or any part thereof; or to enter into contracts for the cleaning, maintenance, supervision of arc lamps used by consumers, or to supply or install and fit up telephones and lightning conductors, or to sell, offer for sale or let on hire any telephones, cigar or cigarette lighters, electric lamps, wires and fittings and other electric accessories for use on the consumer's side of the consumer's terminals, excepting only meters and electric motors, apparatus and other things for cooking, heating and ventilating, and for motive power within the limit of the defendants' supply. In view of the appeal which was contemplated the case was not one in which he was inclined to grant an injunction, and if defendants would give an undertaking to serve notice of appeal during the present sittings he would not do more than make the above declaration and give leave to the plantiffs to apply, if necessary, for an injunction, or generally. Defendants must pay the costs of the action.

Mr. Sargant said defendants were quite willing to give an undertaking subject possibly to this. There was a Bill in Parliament of the Corporation for the very purpose of legalising their action.

His Lordship: Then the appeal will be stayed, but give your notice within five weeks, if possible.

Mr. Sargant said subject to this, that the defendants have liberty to make another application should the progress of the Bill be such that it might be necessary to appeal. He further applied that taxation should be stayed.

Mr. Lawrence objected.

His Lordship said he could not stay taxation. Somebody from Sheffield would have to pay.

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### Alldays & Onions *v.* F. S. Lister.

In the King's Bench Division on Monday, before Mr. Justice Phillimore, plaintiffs, of Birmingham and London, sued Mr. F. S. Lister, trading as the Westminster Ventilating Co. to recover the sum of £81 11s., alleged to be due in respect of electric ventilating fans supplied. Defendant alleged that the fans did not carry out the work required of them and counterclaimed damages.

Mr. Croom-Johnson was counsel for the plaintiffs, and Mr. Cannot appeared for the defence.

Mr. Oswald Stott, manager to plaintiffs' fan department, said that he interviewed the defendant, who was setting up in the electric fan business, and it was arranged, subject to prices being right, that plaintiffs should supply defendant with their fans.

In answer to Counsel, Witness denied that he agreed that the fans supplied should be of a standard capacity, because there was no such thing on the market; nor was any arrangement come to as to the terms of payment, beyond the ordinary terms of business. Witness certainly did not arrange that the terms of payment should be unlimited and subject to defendants' customers being satisfied. A proposal was made that there should be a scheme of working arrangement on which the parties should do business, and in February, 1909, such a scheme was submitted, but plaintiffs never agreed to it, and business relations were conducted without any such agreement being come to, plaintiffs supplying defendant with fans. Plaintiffs did not guarantee that the fans supplied would do any special kind of work beyond that which, in each case, they told defendant they would do.

Cross-examined by Mr. Cannot, Witness said Mr. Lister told him he had a valuable connection in London for the sale of fans, but he denied that he (witness) was anxious that Mr. Lister should act as agent for plaintiffs. It was true the fans required for central station work were costly as a rule, and in his interviews defendant did tell him that guarantees would be required. In any case of induced draught fans, if they had been specified by plaintiff as such and did not do their work properly, no objection would have been raised to taking them back and making them efficient.

In answer to his Lordship, Mr. Croom Johnson said the fans in dispute included two fans supplied for export to Sydney, and a fan ordered from defendant by the Kodak Co.

None of these fans, Witness said, were supplied on terms that they were subject to customers' approval, but plaintiffs were willing to have them back if they did not work satisfactorily. He denied that any guarantee of capacity was given by plaintiffs for these goods.

The Defendant, a consulting engineer, then gave evidence, and said he traded in the name of the Westminster Ventilating Co. He had had considerable experience in the sale of electric fans. When Mr. Stott called upon him in 1909, plaintiffs had a particular type of fan; they desired to put a fan called the "Sirtus" on the market. It had not been standardised at that time, and it was arranged that defendant should use his endeavours to build up a business for the fan in London on behalf of plaintiffs. They agreed to stand by the efficiency, &c., of the fans. A verbal agreement was arrived at during subsequent interviews, with regard to the terms upon which he should take up the sale of plaintiffs' fans. The terms were that he should confine himself to placing the "Sirtus" fan on the market, and if the results were satisfactory, a definite agreement should be entered into between the parties. That definite agreement was never concluded in writing, but the practice established was that he should take up the fan and Messrs. Alldays & Onions should stand by it. Also that there should be no question of payment unless the fans were satisfactory to the people to whom they were supplied. In regard to the fans in question, plaintiffs were late in delivery, the fans had not been tested, and in one case the starter for the motor was missing. At the time of the issue of the writ, defendant objected to pay plaintiffs for the machines because the people to whom he had supplied them had not paid, and the goods were not satisfactory. Plaintiffs were thus wanting him to take all the risk.

In answer to his Lordship, Defendant said he had, since the issue of the writ, been paid for the fans, and he was now quite willing to pay plaintiffs. The only question he was fighting was the question of costs.

There was no other evidence, and his Lordship held that there was not sufficient to show that the goods were not up to requirements. Mr. Lister had been since paid for the fans, and he entered judgment for plaintiffs on the claim and counterclaim.

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### Ellis *v.* Oldham Corporation.

At Manchester Assizes on Monday, before Mr. Justice Bray and a special jury, Ivy Ellis, aged five, claimed, through her next friend, damages from the Oldham Corporation, alleging that, through the negligent driving of a tramcar, she was so injured that she had to have her left arm amputated above the elbow, and also received injury to her leg and hip. The Corporation denied negligence, and alternately pleaded that, if there was negligence, there was contributory negligence on the part of the child.

Mr. A. A. Tobin, K.C., M.P., and Mr. Wingate Saul were for the plaintiff, and Mr. Langdon, K.C., and Mr. Roe Rycroft for the Corporation.

Mr. Tobin said the plaintiff resided with her parents at the Royal Hotel, Rochdale Road, Oldham, and on April 4th, 1911, she was crossing the road to go school when she was run down by a tramcar, with the result that she lost an arm and received such injuries to a leg that she would have to go through life limping. The child was in the infirmary for three months. The gradient of the spot where the accident happened, was one in 28, and the car was going down the gradient. Witnesses for the plaintiff would say that the car was going much too fast, and that the gong was not sounded. At a time when the children were about going to school, the driver of a car must take care, and must so have his car under control that he could avoid accidents that might happen through any ill-advised action on the part of children.

Mr. Chadwick, manager of Kershaw & Bamford's, cotton spinners, of Oldham, said he saw the car pass him, and heard a scream. He did not hear the gong, and told the driver that he had not rung his gong. The driver turned to other people, and asked them if he had not rung the gong. Witness told the driver he was not fit to drive a car.

Several Witnesses were called, who said the speed of the car was at least 20 miles an hour when the accident happened.

On behalf of the defendants, the speed of the car was said to

have been only 8 miles an hour, and it was stated that the child emerged from behind a lorry right in front of the car, giving the driver no opportunity to pull up.

Charles Whiteman, the driver of the car, said he did all he could to avert the accident. He said he sounded the gong and applied the magnetic brake. The child was knocked clear of the car.

The jury found for plaintiff, £380 damages, in addition to £5 for the father.

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### General Electric Co., Ltd., *v.* the Great Western Railway Co.

In the Court of Appeal, before the Master of the Rolls and Lords Justices Moulton and Buckley on Monday, this case was heard upon the appeal of the plaintiff company from an order of the Railway and Canal Commissioners discharging an order for discovery made by the Registrar.

It appeared from the statement of Mr. Disturnal in support of the appeal, that the plaintiff company were alleging that the defendant company had allowed undue preference to Messrs. Belliss and Morcom in the carriage of electrical machinery from Birmingham, where the factories of both firms were situated. The Registrar had ordered discovery of all the documents relating to the case over a period of three years without, it was said, having before him a single concrete case in which undue preference was given. Upon the appeal of the defendant company to the Commissioners, Mr. Justice A. T. Lawrence held that upon an application of that kind particulars of the undue preference must be shown, and that the order made by the Registrar was oppressive upon the Railway Co. The Commissioners, while discharging the order, gave the plaintiff company 10 days in which to give particulars of the instances upon which their case could be based, and the application renewed.

The learned Counsel said that the plaintiff company's complaint was that the Railway Co. had charged Messrs. Belliss & Morcom a lower rate for the carriage of the same class of goods as the applicants from Birmingham to certain stations on the defendant company's system, and to prove that, they required to have an order for discovery for the purpose of getting particulars from the defendant company of the consignments of electrical machinery carried for Belliss & Morcom from Birmingham to the station in question at the "exceptional rates."

Without calling upon counsel for the Railway Co., their Lordships approved the order of the Commissioners and dismissed the appeal with costs.

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### Tramway Co. and Lanark County Council.

In the Court of Session, Lord Ormidale has interdicted the County Council of Lanark, at the instance of Lanarkshire Tramway Co. from applying any part of the sum of £7,500, paid to the County Council in respect of road widening and diversion, towards the cost and constructing new roads, the grounds of judgment being that the new roads were not diversions of highways in terms of the statute.

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### Edinburgh Tramcar Guards.

Judgment was given in the Court of Session last week in reclaiming notes for defenders in two actions brought against the Edinburgh and District Tramways Co., Ltd. In the first case a widow sues for £2,000 damages, and in the second a domestic servant claims £1,000. Both had their left legs amputated as a result of the wheels of the cars passing over them. One of the pursuers alleges that she had taken up a position so as to be clear of the car, but when it was about half way past her the lower part of her skirt was caught by the vertical stay on the right side of the car or became jammed between the main stay and the body of the car. She contends that the defenders should have had the stays guarded. The second pursuer alleges that the guards attached to the cars were worse than useless. Defenders deny fault, and plead contributory negligence, and say there was no necessity for any such guards as were suggested. They state that their cars are constructed in such a way as to occasion no danger whatever to any person using ordinary care. The First Division adhered to the decision of the Lord Ordinary approving of issues for the trial of the cases by jury with expenses.

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### Osram Lamp Works, Ltd., *v.* Z Electric Lamp Co., Ltd.

An application was made to Mr. Justice Parker in the Chancery Division, on Monday, to fix the hearing of this patent action and incidentally to obtain for the plaintiffs further inspection.

Mr. Walker, K.C., Mr. Colefax appeared for the plaintiffs, and Mr. T. Terrell, K.C., and Mr. R. Frost for the defendants.

Mr. Walter said that the action was a long and complicated one. His Lordship would no doubt remember litigation by the Z Lamp Co. that had been before him on a previous occasion. That was sufficiently complicated, but the present action was even more so. His application to fix a day for hearing was a little complicated by the fact that there had been an order for inspection. An order was made that inspection should take place between February 1st and 14th at such times as might be arranged between the solicitors on either side. The inspection involved the defendants' secret process, and Dr. Passmore, who was to make the inspection, was not to communicate to the plaintiffs what he saw, he was only to see Sir James Dewar. Two appointments had taken place, and the defendants very properly desired that their own experts should be present at the meeting. It was now desired that there should be another meeting, and that made it, of course, difficult to say at present what would be a convenient day for the trial. It was a case relating to filaments, and by some unfortunate mistake on the second occasion they could not get the samples, and therefore there must be another inspection. Dr. Passmore had reported to the plaintiffs what he considered to be the result of his inspection, but, of course, he could not report what he had done. He said, however, that there were two patents in respect of which there had at present been no meetings, and it was extremely important to the plaintiffs that they should ascertain something about those before the case came on for trial. What he should suggest was that the trial should stand over until towards the end of the present sittings, and if his Lordship could see his way to retaining the case they might have a day early in next sittings, provided it was inconvenient to dispose of it before Easter.

His Lordship said that he could not fix the hearing for some little time as his list was full. To fix a day at present would be a little premature. He had a case fixed for March 15th, and another for March 20th. He might find a day somewhere about March 25th, but he would suggest that the case should be marked "not before the 18th," and then counsel could renew the application to fix a day somewhere about that date.

Mr. Walter agreed, but asked whether Mr. Terrell objected to the plaintiffs having further inspection.

Mr. Terrell: Yes.

Mr. Justice Parker said that he did not know he had any application for inspection before him then.

Mr. Walter said that was so, and if the other side insisted, a formal application would have to be made in chambers. In that event the case could not come on before March 25th. If the case was marked not before that date, the plaintiffs could go for further inspection in the ordinary way.

Mr. Terrell said he objected to there being a postponement at all, and in support of his objection he had very strong affidavits. He had consented to inspection, and the other side had got more than they had any right to. He had submitted because he did not wish to delay the trial, and in consideration of that the other side had given an undertaking to give notice of trial on or before February 22nd, and they were further to apply to the Judge to fix a day for the trial as soon after March 1st as possible. That was done under these circumstances; they first of all brought actions against the customers of his clients, and they (defendants) had the greatest difficulty in getting them to bring their action. Upon their bringing their action arrangements were come to that the trial should take place early in the Michaelmas sittings. Then they applied for postponement and delivered particulars of objection. The defendants complied with everything they were asked to do, and they said that the postponements were bringing their trade to an end. They had in their possession all the further and better particulars of objection when they gave the undertaking. Having all that before them, there was only the issue of infringement, which they must have known all about when they gave their undertaking. It was only upon pressure that they brought their action. They applied for inspection and were given inspection of everything they wished to see, and all information they desired in relation thereto. The defendants had even offered to place at their disposal a room at the factory, in order that they might try experiments if they so desired. He was not resisting the application vexatiously. It was a most serious matter, as the sittings would come to end before April 3rd.

His Lordship said he did not think he would be able to fix a day before March 18th.

Mr. Terrell: It is nothing like the last case before your Lordship, although my learned friend has tried to make out that it is very complicated.

Mr. Walter: The objections cover eight pages of print, and are the most complicated I ever read.

His Lordship: I am sorry I cannot fix it before the 18th, on which day I have a heavy case coming on. What I will do is this. I will give you liberty—Mr. Terrell undertaking to give you further information this week or early next week—to renew the application to fix a day for the trial at anytime after the 12th.

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### Dean *v.* Hackney Borough Council.

In the Shoreditch County Court on Monday, before his Honour Deputy-Judge Williams, William Dean, of 60, St. Mark's Road, Enfield, sued the Hackney Borough Council to recover £10 10s. for personal injuries sustained through colliding with an unlighted electric standard, which constituted a nuisance on the public highway, whilst he was driving a taxi-cab.

Mr. Martin O'Connor, barrister, appeared for the plaintiff, and Mr. J. B. Matthews was counsel for the defence.

According to the plaintiff, on November 25th he was driving his taxi-cab down Cazenove Road, Stoke Newington, at 6 p.m., when he collided with an electric light standard in the middle of the road, which was not lighted. He had just passed one standard, and thought it was the last, as he saw no light. He was very badly shaken, whilst the two passengers were very seriously injured and had entered actions against both the cab company and the Borough Council. There was a man with a bag of tools at the standard, when he recovered sufficiently to get out of the cab, whom he supposed was there to repair the light. There was no danger signal of any kind, and he thought that at least there should have been a red light.

Mr. Matthews said these standards had been erected in accordance with the regulations laid down by the Board of Trade. There

was nothing in the regulations binding a Borough Council to light an electric standard. They were erected in runs of nine, and a special scout who was out that night discovered that three lights had gone wrong. On investigating he found an earth in the one that was now complained of, so he disconnected it from the cable and the other lights became all right. It was impossible to do more that night.

MR. O'CONNOR: By no means. You could have had a warning light put, and the accident would not have occurred.

MR. MATTHEWS: There is nothing in the regulations to say that we shall stand beside every standard until a light fails, the proposition is too absurd.

MR. O'CONNOR: Not at all. It is discovered that a lamp has gone out, but no effort is made to appriee anyone of the danger, and therefore you turn it into a danger and a nuisance on the highway.

The amount of the damage was not disputed if there was any liability, and JUDGE WILLIAMS said the point as to whether an electric standard, which was unlighted, constituted a nuisance, was a most important one, and he would look up whatever authorities he could find on the point and reserve his judgment.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

3,445. "Reception of call-up signals in wireless telegraphy and other purposes." F. L. MUIRHEAD. February 12th.

3,454. "Electrical measuring and like instruments." J. W. RECORD. February 12th.

3,462. "Switch tripping device." W. L. SPENCE. February 12th.

3,479. "Continuity of electric conduit systems." M. J. RAILING and T. TAYLOR. February 12th.

3,497. "Switching apparatus for telephone exchange systems." E. E. CLEMENT. (Divided Application on 7,611/1911. March 27th.) February 12th. (Complete.)

3,522. "Means for driving an electric dynamo." A. BAKER, A. N. HAZLEHURST and LONGSTRETH'S, LTD. February 12th.

3,532. "Electric distribution systems." BRITISH THOMSON-HOUSTON Co., LTD.; H. W. TAYLOR, F. P. WHITAKER and H. S. SPORBORG. February 12th.

3,540. "Electrical animal exterminators." O. N. CALVERT. February 12th. (Complete.)

3,552. "Registering devices for telephone systems." E. M. NORTHUM. February 12th.

3,555. "Method of and apparatus for generating high-frequency currents." A. HEYLAND. February 12th. (Complete.)

3,556. "Electrically-driven fans." A. SCHAEFFER. (Addition to No. 13,623, of 1911. Convention date, February 11th, 1911, Germany.) February 12th. (Complete.)

3,574. "Electric fitting for the heels of boots and shoes." W. B. MIDGLEY and J. H. IRELAND. February 13th.

3,584. "Appliances for electrically operating points, signals or other devices on electric tramways, railways and the like." C. W. BENTLEY. February 13th.

3,586. "Electric signalling apparatus for military, naval and other purposes." J. N. INGLIS. February 13th.

3,590. "Electric switches and the conductor connections thereto." H. C. SHELDON. (Sachische Gruppenwechselschalter G.m.b.H. Germany. February 13th. (Complete.)

3,595. "Electrical driving mechanism." T. COOPER, H. H. WALE and A. ALLSOP. February 13th.

3,644. "Means for applying an electrical conductive layer upon an electrically non-conductive surface." H. E. GOLDBERG. February 13th. (Complete.)

3,650. "Dynamo-electric generators for velocipede lamps and the like." C. SCHLICH. February 13th. (Complete.)

3,675. "Electric power transmission apparatus." MACFARLANE ENGINEERING Co., LTD., and W. A. MACFARLANE. February 14th.

3,711. "Electric incandescent lampholders." S. W. MARTIN. February 14th.

3,736. "Electrically-operated doors." G. KORYTOWSKI. February 14th.

3,746. "Lamp supports and casings particularly designed for use with electric incandescent lamps." J. S. HIGHFIELD. (Addition to 27,991/1908.) February 14th.

3,748. "Method of obtaining an accurate co-operation of two or more machines, apparatus, or instruments." AKTIESELSKABET HOVLANDS RADIOTELEGRAF. (Convention date, February 16th, 1911, Norway.) February 14th. (Complete.)

3,752. "Treatment of metals." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) February 14th.

3,767. "Construction and method of use of electrical junction boxes and the like." E. T. R. MURRAY. February 15th.

3,772. "Connector for electrical wiring purposes." J. WILKIE. February 15th.

3,794. "Electric storage system." C. F. KETTERING. (Convention date, May 22nd, 1911, U.S.) February 15th. (Complete.)

3,798. "Electro-deposition of metals on articles of china, glass and other non-conductive materials." C. A. OWEN and H. A. HARVEY. February 15th.

3,812. "Electric searchlights." GEBR. SIEMENS & Co. (Convention date, April 29th, 1911, Germany.) February 15th.

3,824. "Electric valve actuation in organs." A. MACQUARIE. February 15th.

3,830. "Time-controlled electrical switches." G. W. FREE. (Convention date, February 15th, 1911, U.S.) February 15th. (Complete.)

3,840. "Electric incandescent lamps." DEUTSCHE GASGLUHLICHT (AUER GES.). (Convention date, November 4th, 1911, Germany.) February 15th. (Complete.)

3,879. "Brush-holders for dynamo-electric machines." S. LEES. February 16th.

3,884. "Combined gramophones and bioscopes for home study or amusement." G. ROBSON. February 16th.

3,915. "Automatically-controlled electric switches." F. P. CLIFFORD. February 16th.

3,906. "Renewable electric incandescent lamps." E. M. BAILEY and W. PLEWS. February 16th.

3,919. "Winding methods for rotating magnet coils." "VULKAN" MASCHINENFABRIKS AKT.-GES. (Convention date, February 20th, 1911, Germany.) February 16th. (Complete.)

3,924. "Means for the electrical transmission of synchronous movements." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, October 13th, 1911, Germany.) February 16th. (Complete.)

3,941. "Governing mechanism." WARWICK MACHINERY Co. (1906), LTD. (Allgemeine Elektricitäts Ges., Germany.) February 16th.

3,946. "Dynamo-electric machines." J. GEISSLINGER and E. SCHLURICK. (Convention date, May 29th, 1911, Germany.) February 16th. (Complete.)

3,952. "Gas and electric light controllers." W. L. SPARKS. February 16th.

3,966. "Apparatus for the operation of electrical clocks by electrical waves." F. SCHNEIDER. February 16th. (Complete.)

3,979. "Electrolytic apparatus." J. T. NIBLETT. (Divided application on 1,671/12 January 20th.) February 16th. (Complete.)

3,980. "Electric cables for automatic telephone exchanges, selectors and the like." WESTERN ELECTRIC Co., LTD. (Western Electric Co., United States.) Divided application on 16,868/11, July 22nd.) February 16th. Complete.)

4,022. "Electrical regulation or control of the flow or delivery of sewage and other liquids." A. BYRON and L. F. MOUNTFORD. February 17th.

4,041. "Carbon electrodes." C. C. GOW. February 17th.

4,061. "Telegraphy and telephony by submarine cables, long distance overhead lines and the like." J. SCHIESSLER. (Convention date, February 18th, 1911, Austria.) February 17th. (Complete.)

4,067. "Telephony." S. G. BROWN. February 17th.

4,073. "Electrical installations for lighting, heating and ventilating railway carriages and for similar purposes." J. STONE & Co., LTD., and A. H. DARKER. February 17th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1910.

PRODUCTION OF SOUND. Eversahed & Vignoles, Ltd., and R. Eversahed. 24,378.

REPRODUCTION OF SOUND BY ELECTRICAL MEANS. S. G. BROWN. 29,988. December 22nd.

CIRCUIT-BREAKING SAFETY DEVICES FOR ELECTRICAL APPARATUS AND THE LIKE. Eversahed & Vignoles, Ltd., and R. Eversahed. 29,986. December 23rd.

### 1911.

ELECTRIC SAFETY HAND-LAMPS. Simplex Conduits, Ltd., and C. G. M. Bennett. 19,847. August 30th.

METHOD OF AND APPARATUS FOR STARTING MULTI-CYLINDER COMBUSTION ENGINES. Firm of Robert Bosch. 20,623. September 18th. (September 22nd, 1910. Addition to No. 13,691 of 1910.)

ARC LAMPS. Körting & Mathiesen Akt.-Ges. 27,669. December 9th. (April 25th, 1911.)

ELECTRIC ARC LAMPS. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) 1,527. January 20th.

TELEPHONIC HEARING APPLIANCES FOR DEAF PERSONS. V. D. Evans. 3,411. February 10th.

METHODS OF AND APPARATUS FOR THE ELECTRIC LIGHTING OF MOTOR-CARS AND OTHER PURPOSES. Van Raden & Co. and M. Metz. 3,549. February 13th.

ELECTRIC CLOCKS. C. Fery. 4,889. February 27th. (March 1st, 1910.)

MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS. "Z" Electric Lamp Manufacturing Co. and F. Hoge. 5,061. February 28th.

ELECTRICALLY-CONTROLLED FASTENINGS FOR RAILWAY CARRIAGE AND OTHER DOORS. C. R. Allen. 5,427. March 4th.

TELL-TALE OR ELECTRICAL SUPERVISION APPARATUS FOR WATCHMEN AND THE LIKE. A. Goldstein. 6,157. March 11th.

CONTROL OF ELECTRIC MOTORS. Allgemeine Elektricitäts Ges. 6,557. March 15th. (March 15th, 1910.)

MEANS FOR AUTOMATICALLY CONTROLLING HEAT IN ELECTRIC HEATING APPARATUS. R. Nightingall. 15,898. July 8th.

WIND-POWER ELECTRIC STORAGE INSTALLATION OR APPARATUS. W. P. Percy. 17,006. July 25th. (Divided application on No. 13,430 of 1911, June 6th.)

MEANS FOR CONTROLLING AND ACTUATING APPARATUS BY ELECTROMAGNETIC RADIATIONS. R. Wirth, S. Beck and W. Knauss. 18,879. August 19th.

EXCESS-CURRENT SWITCHES. Felten & Guilleaume Carlswerk Akt.-Ges. 19,392. August 30th. (August 30th, 1910.)

INSULATION OF ELECTRIC CONDUCTORS. British Westinghouse Electric and Manufacturing Co., K. C. Randall, S. W. Farnsworth and C. L. Fortescue. 20,659. September 19th.

REGULATABLE ELECTRIC RESISTANCES. A. E. Naumann. 20,823. September 20th.

HAND COMBINATION TELEPHONIC INSTRUMENTS. E. H. Graham. 21,351. September 27th.

STORAGE BATTERY ELECTRODES. H. C. Hubbell. 21,783. October 3rd.

ELECTRIC SWITCHES. H. F. Bigge and F. R. Butt. 22,547. October 12th.

ARRANGEMENTS FOR THE WORKING IN PARALLEL OF SYNCHRONOUS AND ASYNCHRONOUS ALTERNATING-CURRENT GENERATORS. Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwere Ges.) 28,263. December 15th.

**Store Lighting.**—We have received from MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, N.E., an illustration of the toy department of a large Sheffield departmental store illuminated by means of tantalum lamps in Holophane Stiletto reflectors. The exceptional number of articles displayed can be easily distinguished in the photograph, which was taken with the lamps switched on. Illumination is undoubtedly essential for effective display, but glare is distinctly offensive. It is claimed that with the perfect diffusion obtained from Holophane glassware, the lighting is evenly distributed, and glare is eliminated. Messrs. Siemens Bros. Dynamo Works, Ltd., who supplied the lamps and glassware for the installation are prepared to place the services of their illuminating engineers at the disposal of contractors interested in this system of illumination with a view to assisting them to prepare complete and satisfactory schemes.